THE JOURNAL OF
Engineering Education

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June, 1953 Vol. 43, No. 10

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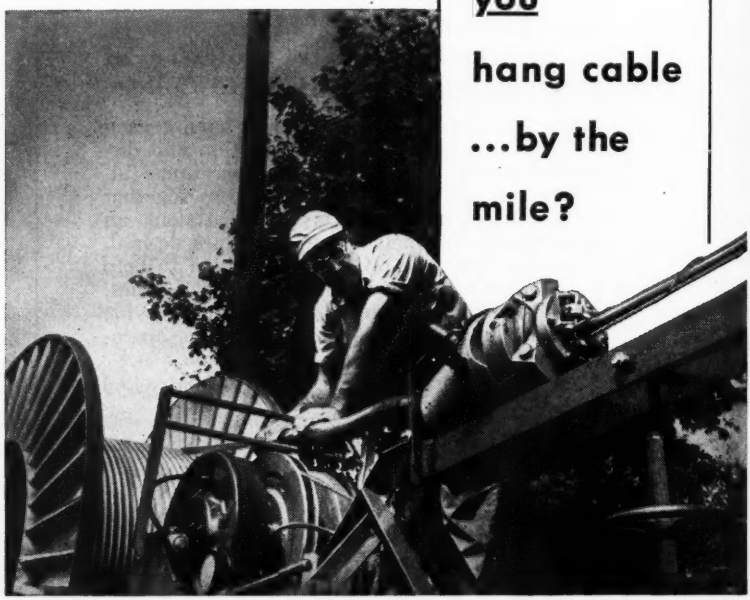

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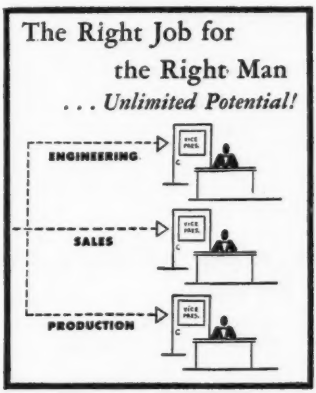

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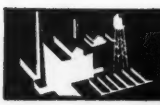

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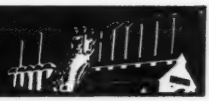

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Emotional Response to Teaching Techniques*

By N. A. CHRISTENSEN

Director, School of Civil Engineering, Cornell University

The emotional reactions of a student toward his teacher play a most profound part in his learning process. If his emotional reactions are correct, almost any technique will work and if those emotions are wrong, no technique will give results.

To more clearly illustrate my meaning, I wish to recall a painful personal experience, from my childhood days, as an elementary grade school student. In my town of 12,000 people, there were four grade schools and one music teacher. Each week he visted each school in order to teach the students to read music and sing simple songs. He taught classes in the fourth, fifth, and sixth grades so my first exposure to his teaching was as a fourth grade student.

Te begin with, music moved along much the same as other subjects in a satisfactory way but with no special interest attached to it. Then came a day when we were asked to write a few stanzas of music, and for some reason, I tried to make mine look like a printed sheet. When finished, it looked neat and a mild feeling of pride was mine as I handed it to the student in the front on its way up to the teacher who was standing at the front of my row. His habit was to glance briefly at the papers as soon as he got them and so I was watching him to learn his reaction. One, two three; mine was the fourth down from the top of the pile. When he came to it, he paused a little longer than usual, smiled and handed the paper to our regular room teacher saying, "It looks like a printed sheet." This was exactly what I had been trying for and his offhand remark, unknown to him, had a profound effect upon my efforts in music for the next year. My interests in the music teacher as well as in music sharpened. For the first time I noted that this man could sing all four parts of almost any song. Gee, what a *singing range* this man had! I learned he was also the conductor of the church choir and admired his masterly control of over 100 singers whom he trained. In my mind his greatness as a musician was finally and solidly confirmed when he led the congregational songs. You could hear his voice above all who sang even though the number of singers sometimes exceeded one thousand. Boy, what *volume* that man had!

With this state of mind and emotions, his classes became a pleasure for me. When he would say sing, I would do so with all my might and I knew I was making real progress. My confidence grew and I took the responsibility to sing out so that my seat neighbors followed my lead when we sang.

By this time, I had a slight touch of swelled head, an ailment so common among fourth graders of which, of course, I knew nothing. It was true the other students were following my lead in singing. This exaggerated my ego and in my own mind I was going to march right along and be like the teacher himself, until one day I made a sad mistake. We were reading music in the do, re, mi fashion, and came to a long run of notes forming an ascending scale which ended in the top space of the staff at a note called re. To my sorrow, in climbing this musical scale,

* Presented at Upper New York Section Meeting of ASEE, Oct. 11, 1952.

my reading got out of gear with my singing and lagged it by one note so for me there was still one more note, mi, to sing when the class had reached the top and I hit that mi with all my might. Because of egotism and false confidence, I held it for its full count.

My budding music career as well as my ego collapsed with the burst of laughter and ridicule from the class. A blush of shame burned my face and made me look even more ridiculous to all present. My idol, the music teacher, completely misunderstood my error and interpreted it as a show off. My cup of grief overflowed when he proceeded to soundly box my ears.

My hero, the music teacher, suddenly became a crude baboon with heavy powerful hands. It seemed to me that he had a tendency to show off for the benefit of the pretty homeroom teacher. His range was not so marvelous after all, only two octaves. Any good baritone should have two and a half. His strut before his choir now annoyed me. What a horrible mess he made of congregational songs, his voice rose above the singing of the congregation like a bellowing bull. What a fool I had been not to see his true color before, but now I knew, especially since my pretty cousin had told me that he had tried to put his arm around her. He is just a grandstander for those females who are silly to fall for him.

Three years later I suffered no pangs of sympathy when the newspaper reported him laid up in bed with painful arthritis. It was eight years before I reluctantly consented to join his choir but by this time my ability to read music was still embryonic and so the best I could do was to follow my older brother who had had a more happy experience under this master of music.

Looking back now, the true nature of the experience is clear. The slap I got did not change the teacher, his technique did not change, his personal qualities did not change, it just seemed that way to me. The slap changed my whole frame of reference for judging him and his techniques. Before the slap he was wonderful and I was a dilligent student making good progress. After the slap he was the lowest of humans. I was balked and my progress in music stagnated. Any technique which improves the emotional relations between student and teacher is good. My teacher's observation that my written music was neat, was good technique; his slap was bad technique. The commendation conditioned me emotionally to learn; the slap raised enormous emotional barriers.

These emotional adjustments are not static. They improve or decline. One very important factor affecting this rise and fall is the progress which the student makes. The changes are usually much more gradual than mine, when I got slapped, but nevertheless each action of the teacher has its effect upon the student-teacher relation. An alert experienced teacher will sense these changes and adjust his techniques in accordance. The sum total effect of a teacher's techniques, build or destroy the students emotional adjustment to him.

Guiding Principles

There is enough uniformity of response of students to permit the statement of a few general guiding principles.

1. Watch the students and judge your techniques in terms of the reactions and activities stimulated in the student. They learn only by their own mental activity. You can't pour knowledge into them.

2. Master the subject matter. A complete knowledge of one's subject is necessary, especially in basic undergraduate courses. Without complete command of the subject matter, the teacher will not have time to study the reactions of his students in the relatively large undergraduate classes. The highest form of student respect is not possible if the teacher is not master of the material he is teaching.

3. Use a variety of approaches to the subject matter. In the *Journal of ASEE* last May, Mr. Harry W. Case, Associate Professor of Engineering and Psychology of the University of California, in report-

ing the results of his questionnaire to students on teaching techniques, emphasized the importance of this item and the danger of monotonous teaching.

4. Attack the job of teaching with enthusiasm and vigor. Whatever techniques are selected use them with gusto. Students become alert in the presence of such a teacher. This vigor should have a natural quality such as grows out of a feeling of having something good one wants to transmit.

5. Put the students at ease. Students should feel free to state their own ideas, without fear of ridicule. Admit your own errors freely and students will then do likewise. Crack a joke on yourself once in a while, a sense of humor will ease tensions and make the teacher seem more human to the students. Care on this point is necessary, however, in order not to impair respect for the teacher and class order.

6. Strive for an atmosphere of ease dignity of the type which grows out of living up to our professional codes of ethics. A commendation of a fellow teacher before a class, in a subtle but powerful way, adds stature to the teacher giving the praise, providing it is sincere. Cheap jokes should be avoided like the plague. They are distructive of dignity and, worst of all, their telling is highly contagious.

I am afraid that these six points may seem like platitudes. The ideas are common but they do not qualify as platitudes, because they are not given as new or profound. They are as common as an old shoe but nevertheless of basic importance.

One cannot be much more specific in recommending teaching techniques because if he does, he faces the danger of reducing the teaching process to a mechanical routine. Administrators of education, I believe, should not insist on teachers adherence to a specific set of techniques because by doing so, they may lose the value tied up in each teacher's own personality. His adjustment to his students will be made best if he is free to sort the techniques to fit his own classes and himself. All teaching techniques can be rightly considered as only means to an end. That end being to establish emotional relations between teacher and student most ideal for the transmission of knowledge.

College Notes

The potentialities of modern electronic processing systems will be emphasized during a two-week Special Summer Program on Digital Computers and Their Applications from August 24 to September 4 at the **Massachusetts Institute of Technology**. The program is especially designed, according to Dr. Ernest H. Huntress, Director of the M.I.T. Summer Session, for those unfamiliar with digital computers who must determine how newly-available computing systems can be applied to their problems and the advantages that might accrue. No previous training or experience beyond a bachelor's degree in business, science, or engineering will be required. The program will be under the direction of Charles W. Adams, Assistant Professor of Digital Computation in the Department of Electrical Engineering. He will be assisted by other members of the staff of the M.I.T. Digital Computer Laboratory, who will act as occasional lecturers and as instructors for small working groups.

Curriculum and Cocurriculum*

By C. MARTIN DUKE

Associate Professor of Engineering, University of California, Los Angeles

This paper developed from an effort to think out the place in engineering education of the non-academic activities given much emphasis in most American engineering colleges. A certain pattern has been found in the methodology and objectives of these activities, and the name cocurriculum has been adopted for them. The pattern is presented here in the hope that it may stimulate discussion leading to clarification of the role of engineering cocurricula..

The objectives of engineering education may be stated to be the development in graduates of intellectual capacity and professional attitude. These are attained through the devices of curricula, or groups of courses, and cocurricula, or groups of activities. A diagram of engineering education is presented in the chart of Figure 1 to show the functions of curriculum and cocurriculum. The definition of the latter term proposed by the writer follows:

> The cocurriculum of an engineering college consists of those activities paralleling the curriculum which are carried out by students, faculty, and practicing engineers with the objective of developing a professional attitude in students toward their education and in graduates toward engineering work.

The activities mentioned are here classified as student activities, personal functions of faculty and professional engineers, guidance, inspiration, recognition of and aids to achievement, and contact with engineering practice. The professional attitude given as the objective of these activities is a complex of several states of mind or attitudes which are herein classified as morale, orientation, purpose, motivation, and preprofessional engineering experience. These five states of mind characterize the professional attitude required in graduates and also that required in students toward their education. The quality of the result achieved by the cocurriculum depends firstly on the moral caliber of the students and secondly on the excellence of cocurricular planning and execution.

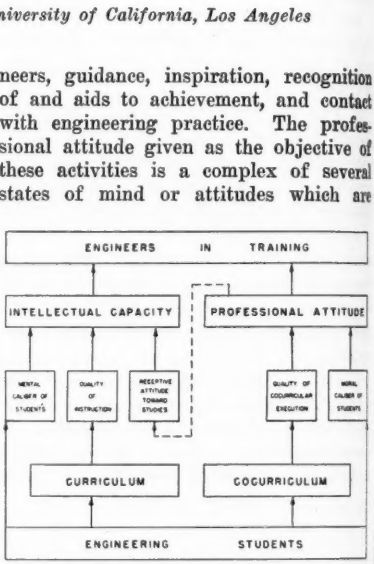

FIG. 1. A diagram of engineering education

The intellectual development required in engineering graduates is the concern of the curriculum. It is the principal objective of the academic portion of the student's collegiate experience and is concerned with the capacities of analytical

* Based on a paper presented at the annual meeting of the Pacific Southwest Section, American Society for Engineering Education, December 27, 1951, Reno, Nevada.

power, creative thinking, skill with the engineering method, knowledge of engineering subject matter, and understanding of society. The result achieved depends on the intellectual caliber of the students, on the state of mind of the students toward their studies, and on the planning and quality of instruction.

Curriculum and cocurriculum do not exist as separate entities (though usually they are operated separately in engineering schools). For example, purpose may be stimulated as well in the classroom as through contact with practice, and technical and humanic knowledge is abetted by field trips and student organization experience. Further, as illustrated by the dotted line in Figure 1, the cocurricular activities should do much toward developing a receptive attitude toward the academic work.

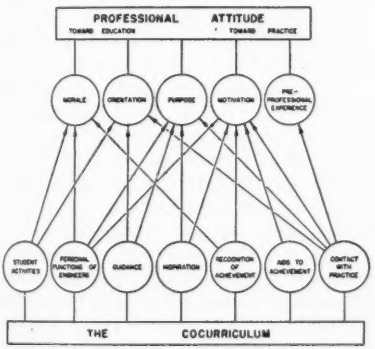

FIG. 2. The cocurriculum

Figure 1 illustrates how the engineering educational process, working through the curricular and cocurricular stems, may produce high caliber engineers in training. In Figure 2 the activities and attitudes given above are charted, and predominant cause-and-effect relationships are shown by arrows. As in most block diagrams, oversimplifications exist in both figures: mental and moral calibers of students are not static things but fluctuate with development of attitudes; forces outside those considered, such as family and personal experiences, often predominate; feedback plays a major role in planning activities to develop attitudes. The following two sections define and describe the elements of the cocurriculum shown in Figure 2.

Activities of Students, Faculty, and Practicing Engineers

Most quickly recognized of the cocurricular activities is the group conducted by the students through their organizations and publications and labeled *student activities.* They have great morale value on account of the informal personal associations among students and between students, faculty, and practitioners. Services to the college and operation of an honor system help set the stage for accepting professional responsibilities to society. Working closely and voluntarily with other students helps to prepare graduates for the cooperative nature of engineering.

Seldom deliberately exploited by faculty and practicing engineers is their influence on student morale, purpose, and motivation by virtue of their personal example, reputation, fellowship, and advice. These *personal functions* are accomplished for better or for worse through intimate associations with students and groups in the classroom and office, in student organization affairs, and in preprofessional employment. Integration of the curriculum with the cocurriculum is achievable only through the cooperation of the faculty.

Particularly important in the precollege and early college years is *guidance,* including counseling, directed toward orienting and stimulating purpose in the students. In addition to the academic and career counseling and guidance given considerable attention in modern engineering schools, guidance should be provided in connection with features of the cocurriculum such as student activities and postgraduate professional activities.

An item of recognized primary importance, but difficult of definition, is *inspiration.* Certain inspirational activities car-

ried out by faculty, the profession, and industry, through programs and personal associations, are designed to stimulate imagination and emotional drives and thus to achieve motivation and purpose. Least tangible element of the cocurriculum, inspirational functions usually are accomplished only incidentally to other activities. A few professors and deans do make conscious effort in this direction, often with modest success.

Colleges and student organizations provide for the *recognition* of both curricular and cocurricular *achievement* through the media of degrees, honors, honor societies, student society officerships, etc. Prizes and honors also are conferred by the profession and by industry. Such recognition stimulates morale and motivation.

Aids to achievement are similarly provided as stimuli to morale and motivation. This group of activities includes such items as tutoring by honor students, study facilities, scholarships, loans, and facilities for student organizations.

Every engineering student's collegiate experience includes some *contact with engineering practice.* Practicing engineers and the employers of engineers perform a guidance and inspiration function here in creating the mental states designated as orientation, purpose, and motivation. In addition there is provided training and experience implementing the objectives of the curriculum. Students come in contact with practice during cooperative work study programs, on field trips, and by attending meetings of professional engineering organizations. The impact of this type of cocurricular activity can be very great.

Attitudes Developed through the Cocurriculum

As an ingredient of the professional attitude toward his studies, the student firstly should be enthusiastic about his engineering education and further should conduct himself in an honorable manner in his relations with faculty and fellow students; such a state of mind, existing in students individually and collectively, is called *morale.* Its symptoms are confidence, loyalty, honor, pride, enthusiasm, and good fellowship. It is stimulated by extracurricular student affairs and by proper attitudes of faculty, administration, and professional engineers. This morale should transfer to his professional life after graduation with the added items of loyalty and pride in the profession and in his alma mater.

The student should understand and should possess some perspective regarding the organization and workings of his college and of the engineering profession; this is *orientation.* Implied is the understanding of and willingness to accept academic and professional responsibilities. The orientation picture should comprehend the possibilities of shifting to peripheral curricula while in college or to peripheral jobs after graduation. Guidance and counseling activities, special courses, and preprofessional employment help to effect the desired orientation.

Purpose is an ideal approached by the student as he proceeds in the selecting of academic and professional life goals. Examples of goals are options in the curriculum, student society officerships, first jobs, long range career achievement, contributions to the profession and to society, etc. It is not to be expected that concise and constant goals will be selected by most students while still in college. Chance will always play a role. Inspirational association with men and projects, and contacts with engineering practice, render much aid in the selecting of engineering goals.

Students should be possessed of the emotional driving force enabling them to make progress toward the goals selected in the oriented picture; this is *motivation.* Classroom activities, inspirational experiences, recognition of and aids to achievement, and contact with practice all influence motivation as do many non-collegiate factors. Without motivation the student cannot achieve success either in college or in practice—a fact that teachers and advisers must have always in mind.

An introductory knowledge of some of the arts and skills of engineering should be obtained by the student before graduation to give him *preprofessional experience.* This item, while not classifiable as an attitude, nevertheless represents in addition to intellectual growth a certain maturity of mind which is a desirable cocurricular result.

Applications

Present use may be made of the presentation herein as an aid to seeking solutions to problems such as the following:

1. Emphasis to be placed on both the activities and the attitudes of the cocurriculum during each of the four college years and prior to college; related questions of what should be the philosophy of the cocurriculum in the first two years including junior college, in the second two years, in graduate school, in technical institutes.

2. Devising methods of measuring the effectiveness of cocurricula and their various elements.

3. Planning of activities to encourage a particular student reaction or attitude, such as orientation, morale, motivation, etc.; possibility of devising and evaluating inspirational programs in and before college.

4. Optimum proportions of student and faculty time to be devoted to the cocurriculum.

5. Emphasizing to the faculty and to the profession the key roles they play in the cocurriculum.

6. Decreasing the mortality of engineering students; related problem of easing the impact of failure on individual students while maintaining in the student body a philosophy of success.

The writer's thinking in connection with this paper and with the above list of problems has been aided by use of a large chart showing greater detail than it has been practicable to present herein. A limited number of copies of this chart is available to interested persons.

Summary

It is maintained that cocurricula are operated in engineering schools in order to encourage in students a professional attitude toward their education and toward engineering practice. This attitude is characterized by states of mind identified as morale, orientation, purpose, motivation, and preprofessional experience. The cocurricular activities carried out by students, faculty, and profession are all identifiable with one or more such states of mind.

It is hoped that by this presentation the thoughts of engineering educators will be stimulated toward further contemplation of the objectives and toward more effective planning and execution of the activities of the cocurriculum. If cocurricular experiences and philosophies of educators are catalogued over the coming years, it may become feasible to design ideal cocurricula.

The Engineer as an Individual in Industry

By H. N. MULLER, JR.

Assistant to Vice President, Westinghouse Electric Corporation

My assigned title for this discussion is "The Engineer as an Individual in Industry." There is just one key word in that title—"Individual." All of my remarks will concern the individual; the freedom of the individual, the dignity of the individual, the development of the individual, the retention of individual thought and action in a team atmosphere, and most important, the necessity for all these ingredients in maintaining our industrial strength—the keystone of a strong America.

Our industrial strength is inseparably coupled to the individual. I firmly believe that our vast productivity could never have been accomplished, on a *continuing* basis, under any character of economy other than our free enterprise system of American industry. We have produced so abundantly because in America we have had individual liberty; freedom for the individual to pursue his own ambitions, to save and to risk, to gain and be responsible for his own decisions and actions, good or bad, win or lose.

If this dignity and freedom of the individual is ever lost in America, our strength will inevitably decline with it. Our philosophy of life is the key reason for our strength. We have great natural resources, but there are nations with greater raw resources. Americans can certainly be no more intelligent than the people in the lands from which Americans came. We don't work harder, or even as hard in terms of expenditure of human energy, as the people of many lands. You may say that our great educational system makes the difference and is responsible for our strength. But this educational system is just one product of our basic concepts of individual freedom and individual opportunity.

We have been able to build the America of today only because all of our people are free to *think* and *act* as individuals, *each* to express in his *own* way his *creative, productive,* and *cooperative talents* that collectively result in national wealth, strength, and high standards of living. These fundamentals apply to men of all skills and educational levels, from common laborer to professional practitioner. And among the professions, the engineers have emerged as the group most critically important to the continued strength and future growth of our industrial backbone.

The Place of the Engineer

Let us analyze briefly the position the engineer occupies in industry. He has grown to be our key man. His influence predominates in almost all functions of a modern industrial organization. An increasing number of the other skills and specializations are dependent upon the creativeness, the productive genius, the analysis and the application of the engineer before their functions have usable significance.

More than any other group, it is the engineer who has created the vastly complicated maze of modern industrial society. With every additional technical innovation, the degree of complication increases, and an engineering background becomes a requisite for more and more of the key jobs.

This necessity for technological understanding applies to the productive organization and to all levels of management, as well as to the directly technical pursuits

in the departments of engineering. It is interesting to observe that over one-third of the top management people in America's largest producing corporations are graduate engineers. This percentage will continue to increase in the future for it is an inherent necessity.

Now let us relate this crucial station of the engineer to his thoughts and actions as an individual. In recent years forces have been at work in our country that would reduce the status of individuality. Our people are constantly lured by all kinds of schemes for collective security, by all kinds of "isms" and devices designed against some of our most basic ideals. The worst of this is that it is being done in the name of "liberalism" and "progressiveness." Each "liberal innovation," so called, with a professional do-gooder as its advocate, sounds like a real bargain. All put together, they simply mean that individual initiative is replaced by government paternalism, that self-confidence is replaced by collective reliance, and in the end, that dependence replaces independence. At that stage, security through government has replaced freedom, whether economic, political, or eventually religious freedom. It is an insidious, creeping kind of paralysis. It provides its own anesthesia until it is very late and hard to arrest. We have traveled down this road regrettably far already, but the engineers, through their unique post in industry, are the one group who can do more than any other in showing to a free people their self-created peril. This requires action, not just words, and it must come from the grass roots level by all engineers in industry.

Specifically, look at this problem of security as it relates to engineers in industry. Certainly the urge for security has always been in the breasts of men, and properly directed, it is a driving force responsible for much of our material progress. But this is only true as long as we define security as individual security. There is no basic driving force in collective security; indeed, individual action, achievement, risk and gain, are strangled by collective security. This must be made unmistakably clear.

In recent years industry has been met with all kinds of demands for greater security. These demands include sickness benefits, hospitalization plans, bigger and better retirement guarantees, an annual wage, absolute seniority almost regardless of ability, and numerous other forms of collective action. Some of these demands are decidedly good movements and they are entirely justified, but others are not. In few cases have the demands been related to individual achievement, and I have never seen the proponents of these plans point out that all payments inevitably must come out of production; hence, from the consumer.

Engineers can achieve real and enduring security as can all professional people who are both competent and ethical. Such security is founded on the dignity and freedom of the individual, never on collective security, and it has been achieved by thousands. It is based on the individual's real value to the community, the industrial economy, and the national welfare through his reputation earned by constructive service.

To be frank in a point-blank manner, any collectivism, including our common concept of unionization, is incompatible with truly professional performance. Collective action, however highly conceived, will eventually result in a leveling process, and will inherently result in a strong influence toward mediocrity for the individual. At that point, the professional man loses some of this ingredient of individuality. The freedom that creates a vigorous professional attitude has begun to wither, and if the process continues indefinitely, it may die.

All of the engineering students and young engineers in industry must be instilled with an appreciation of their responsibility to the profession as individuals. They should carry this inspiration through the span of their professional service if they are to fulfill their obligations and realize their opportunities in America.

In short, if security is based upon earned reputation resulting from active pursuit of opportunity, the achievement of that security is worthwhile, it has contributed to the development of the individual, and it has advanced our profession. Grasping opportunity and realizing the fruits of accomplishment is real security; any other security cannot be enduring.

The Employer's Responsibility

We have observed that a great majority of the young engineers initially entering industry have the motivation toward individual accomplishment so necessary to professional growth and a maximum rate of progress. This fact is a real tribute to the job our engineering colleges do in the more abstract elements of a professional engineering education. There are exceptions, of course, but most are really healthy minded youngsters, looking forward to opportunity in American industry. What, then, are the responsibilities of the industrial employer in seeing that this inspiration is nurtured and that the young graduate's ideals are realized?

First, industry owes the young engineer the opportunity to know his organization and to find the right job in it. It is industry's obligation to provide high-level, flexible orientation and training.

A good program of training has so many benefits. The transition from directed-development in college to self-development in industry is no longer an easy one. While the craftsman of former years grew up with the business, the college graduate of today steps into a strange organization at a relatively high level. He has had no opportunity to understand, through long association, the methods and operation of the concern. During his first few years with the company, the young engineer is finding his place in the organization, attempting to understand himself, and shaping his professional goal. Frequently, he is establishing his family and generally his salary is modest. Closing the gap between his experiences on the campus and the realities of earning a living in a complex situation is not an easy task. Obviously, he needs assistance in making the transition from directed-development to self-development, and his faith in himself, thus bolstered, maintains his individuality through a crucial period.

Many industrial employers have recognized this need and currently do a good job of orientation and training. Unfortunately, not all do. It is interesting to observe that there are valuable by-products that turn up as a result of a good training program. Some of these have a very broadening effect. An industry that was new to a young man a short time before employment, now becomes a dynamic entity, and he feels a part of it. A *good* training course brings the engineer into contact with the best men available for training work, and in this way has an excellent influence on his behavior that he will never lose. He unconsciously has built fences against the influences that can reduce his professional status and his individuality.

Healthy Attitudes

A good training program instills healthy attitudes. The young graduate has been carefully selected as a potential key man. He reports to work with high hopes to really wade in and build a reputation. These hopes are further elevated when he finds that his company is devoting the time and effort necessary to acquaint him with its policies, objectives, and all phases of operating procedure. He knows that he is, at best, only semi-productive and yet the company sees fit to pay him a salary while training him. Certainly this company must have plans for him!

Contrast this with the direct employment case; that is, hiring an engineering graduate for a specific job and plopping him into it with no training period. He starts becoming a productive employee the first day, and many years may pass before he learns, piece by piece, what the overall company operation is and how it is organized. He learns the hard way what facilities and services are available to him, and he may make many embarrassing mistakes.

He feels rather lost in a strange world during his first few years and does not realize where his opportunities may lie. In short, he is being almost pushed into that uncertain state of mind that makes him easy prey for influences not compatible with maximum professional development.

Frequently we hear the comment, "Fine, but a smaller company cannot afford much of what you were talking about and, therefore, cannot assume such responsibility." With this opinion I heartily disagree. As a matter of fact, a smaller company, taking only two or three graduate engineers per year, has the greatest opportunity possible to personalize their orientation and training period. Because the organization is small, closer contact with the men of experience and leadership in the organization is possible. Elaborate classroom set-ups, essential in the big company, are not necessary in the small one.

It would seem that the sincere employer should consider high-quality training to be an obligation, and professional growth a challenge. It is certainly one way to help our young engineers "do more quicker" and to that extent have the effect of increasing our numbers, thus offsetting our present shortage. I think you know that training has had a prominent place in Westinghouse operation for a long time, and I can attest to its effectiveness in making engineers a part of the productive organization quickly.

In addition to a good program of training, another measure employers can take to develop the individual is to urge their younger men to continue their education. Nothing enables a man to accomplish the maximum amount in his job better than good learning habits. His morale as a budding professional man is kept high if the employer encourages and assists him to supplement his college training by evening classes or guided self-study. In the graduate study programs we provide, in cooperation with ten universities, hundreds of our engineers are currently broadening their horizons through advanced education. Such study includes both technical and general types of courses, and the maturing and broadening effect is obvious to management.

We recognize that physical location, or other factors, may not permit all organizations to sponsor such formal programs of graduate study. However, encouragement and guidance from supervision will get many recent graduates started on their own in healthy self-improvement programs.

Another facet in the development of the individual employed in industry is his community life. Without going into detail, it can be briefly stated that this element of growth is the one most frequently neglected by industry.

Civic Development

Engineers have a reputation for being backward in civic programs and civic development. By the time the engineer reaches forty years of age, he probably occupies a position of respect and some prominence in his community. Why wait fifteen or twenty years to get started? Give the junior engineer in your company, or in your engineering society, or in your community a job to do! Make sure he is welcomed, introduced to his seniors, and that his efforts are recognized. Give him tactful guidance, of course, but then look out for his smoke, for the energy and enthusiasm of youth, once kindled, is a powerful driving force. The employer is in a key position to make the initial effort, but only a few really make an effort.

Finally, what happens when these young engineers begin to feel their professional oats; that is, when the transition period from academic life to practice is behind them and their horizons begin to broaden rapidly? At this point the employer has another obligation to youth. We must never be guilty of blocking a man just because he has a healthy boss. We must stand ready to recognize developed ability once it is present and keep the engineer whose "star is still rising" up to his limit in increasing responsibility. He will only continue to develop at a maximum rate if his work is a challenge to

his ability and experience, so that while he *can* keep his head above water, it is *not* without some struggle. If you are careful to place young engineers in jobs where continued challenge exists, you may be amazed to see how rapidly they grow to meet the opportunity that they, then, are able to see.

This leads us directly into the whole subject of management development. We do not have time to discuss this subject, but I will remark that our organization has embarked upon a comprehensive, formal program of management development and we are confident of important results. It will insure that the more mature men of potential recognize the horizons before them and it should guarantee that no man will be unprepared when opportunity is present. Through this management development program, we will make our men of potential more effective in their jobs and ready for increased responsibility quicker. This has the collateral effect of increasing our numbers through the broadening of individuals.

Conclusions

Our profession of engineering is responsible for most of the material progress in the world. With each technological innovation, the position of the engineer becomes more prominent, and the role of the engineer more necessary. In the nineteenth century, the engineer invented things and sometimes built things on a modest scale. In the past fifty years the engineer, besides inventing, became the expert on materials and processes, and thus created a mass production world, vastly complicated in nature. As we enter the second half of the twentieth century it is evident that the engineers are the ones who must be responsible if our accelerated pace is to be maintained. Furthermore, the engineers will have to run our enterprise, for as cited at the beginning, with each increase in the complication of our technical society, an engineering background becomes a requisite for more and more of the key jobs. Even today graduate engineers fill more of the top management jobs than people of any other one educational background. This trend will continue until a preponderance of all key men of management will be engineers.

What a tremendous responsibility this is! Our profession is rapidly ascending to a position where our members can, if they will, be the greatest single influence in the future of America. So we *must* keep our thinking broad in scope. We cannot allow our routine tasks to dull our vision. We *can* insure that young engineers receive guidance and work in an environment that will preserve the American system of enterprise and stop the fuzzy, foggy, economic thinking that would destroy our loftiest ideals. We can do a professional job of providing healthy internship for our junior members, including the proper introduction to their professional societies and their communities. Continued leadership of America can only be possible if our professional people are free to think and act as individuals in a free economy. Creative thought cannot endure in any other atmosphere. We owe the rising generation of engineers all the guidance we can offer, because they in turn are going to have to assume the responsibility of bringing the next generation into an even more complicated way of life.

Critical Evaluation of Counseling Received as Undergraduate*

By LILYAN B. BRADSHAW

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To anyone who has ever made a study evaluating opinions or impressions of human beings there finally comes that fateful moment when he stares vacantly at a pile of statistics, that has been so painstakingly assembled, and asks himself, "Now that I've got it, what have I?" Facts and figures are interesting enough in themselves but out of them must flow an analysis of information if they are to serve a purpose.

To begin with I hope I am not assuming too much in stating that no one who ever attended college escaped the effects of counseling in some form. As we grow older much of the textbook material we worked so hard over as students fades into a limbo of the forgotten past (those professors who wrote the texts will please forgive me) while the wise counsel and helpful advice we gleaned from kindly instructors along the way remain forever with us.

Student guidance and counseling are an irrefutable part of teaching. Whether a professor limits his contacts to the classroom or invites his students to his office for personal interviews he is serving as an advisor. The poet has said "There is a tide in the affairs of men which, taken at the flood, leads on to fortune." If ever there is a time in a human's life when he needs direction it is during the flood crest of youth, for it is then that his physical energy, mental keenness and acquisitive nature all assert themselves. Teeming as he is with these vital factors and eager as he is to employ them to his ultimate advantage, he recognizes the need of leaning on the counsel and wisdom of those more mature. It is for this reason that counseling received as undergraduates in our colleges is of the utmost importance and not something to be viewed as extra-curricular and insignificant.

This paper of course is concerned exclusively with engineers and a critical evaluation of the kind of counseling they have received as undergraduates in our universities. Because I have learned by association that engineering alumni of five minutes or fifty years are always most willing to look back on their college days and give forth quite freely with advice, I decided to contact a nationally representative group of universities and ask for the cooperation of the deans in soliciting their alumni for answers to a rather brief questionnaire. The schools selected extended from the east to the west coast and from Canada to the deep south. Out of 31 schools thus approached only five refused to participate and in most cases for understandable reasons. One other regretfully admitted it never had had any form of counseling hence could anticipate the unanimity of negative replies our solicitation would receive.

Each school was asked to select fifty alumni from the past ten years and send the questionnaire to them. From a total of 25 universities participating, 579 replies were received.

It was interesting to note the similarity

*A paper presented to the "Relations with Industry Division" of the ASEE. Dartmouth College, Thursday, June 26, 1952.

of proportionate answers which prevailed regardless of the size of school or region of location. In other words the comments, attitudes, and opinions of engineers toward college counseling seem to fall into a definite pattern which would have valuable significance to any university attempting to set up or improve its guidance program.

We found 311 had regular counseling while in college as opposed to 268 who did not. Such guidance was by a professor in 280 cases, by the dean in 102 instances and by the placement director for 75. Group meetings were the source for 71 while 34 claimed miscellaneous contacts. In 306 replies, counseling was voluntary and in 141, required.

Surprising Answers

Perhaps the most surprising answers were recorded to the question "Were you counseled during your freshman year concerning your choice of engineering as a career?" 244 answered "Yes" and 294 said "No." From this fact we judge that more than half of the students who elected to follow the curriculum of engineering were never questioned as to their suitability after they once entered.

Faculty members who do not limit their interpretation of duty to the classroom alone but who take time to become personally acquainted with their students are responsible for the overwhelming affirmative of 528 to 43 in answer to the question "Was there a member of the faculty to whom you could go to discuss your various problems with a feeling that you would be met with understanding and from whom you would receive a fair opinion?"

Our next question opened the doors wide to criticism as we inquired "Where did your school fail most in counseling?" In spite of the implied assumption that it had failed almost every group had alumni who flatly stated "It did not fail." But for those who took advantage of this opportunity to critically evaluate undergraduate guidance the greatest fault was laid in the first year where it was felt that aptitude tests should have been used and student interests and capabilities analyzed. Some regretted the lack of a well planned counseling system that extended not only throughout the entire college period but on into employment problems. Others wished a greater emphasis had been placed on the broad scope of engineering and its breadth of application. A few felt their faculties lacked sympathy or were not sufficiently experienced industrially. Some commented that there were too many students assigned to each counselor. Others decried counseling only for unsatisfactory work and the fact that their schools did not encourage faculty conferences.

Constructive criticism poured forth in reply to the question, "What suggestions do you have for colleges of engineering whereby they could do a more thorough job of counseling their students?" These answers were stated in a most frank and helpful manner with some participants even expressing their appreciation for having been solicited.

Desired Pattern

Guided by these comments, the following pattern seems to be the one most desired by engineers. Careful analysis will divulge the fact that it is sound, adequate and not out of the reach of any average university staff to effectuate.

First of all it was felt that guidance should begin in the high schools where early interests of young students could be directed in an exploratory way toward those subjects which are basic. Aptitude and intelligence tests were highly recommended during the senior year of high school and as a screening method prior to, and during, the freshman period. Close counseling on a compulsory basis throughout the first year of college was strongly advised with a follow-up for all students at the end of the second year to verify the sustention of engineering interest and capability. Lectures by industrial representatives should be open to lower classes and attendance encouraged.

Heavily emphasized by the majority was the need to develop a closer faculty-student relationship and those who re-

alized the time factor which limits this in many schools, went further by urging that each faculty member should be regarded as a counselor and his teaching load adjusted accordingly.

The importance of orientation courses, particularly in the first and last years, was pointed out. Also recommended were small, informal groups for counseling purposes in which alumni and upperclassmen could participate. It was felt that by this means, topics of mutual benefit could be developed and new ideas stimulated. This suggestion has particular value for the reticent type of youth.

Two comments that were almost unanimously made were:

1. School should give advice on entire field of engineering training, and
2. School should present frank and accurate picture of industrial opportunities for engineers.

It would seem that there is a lack of understanding on the part of students as to the broad aspects of engineering training even on the educational level—and there is also a definite confusion in many of their minds as to just what their specific expectations might be in connection with the adaptation of their training to industry.

Some felt that schools and industry should develop a closer liaison. As a part of this program the values of inspection trips and summer work experience were emphasized. Favorable comments were made on the help that could be derived from industrial representatives as frequent campus speakers. Schools were advised to urge the participation of young engineers in student activities as an invaluable means of broadening their scope of development.

Professional registration, and the part the college program should play in encouraging it, was strongly brought out.

The tremendous importance of courses in report writing and public speaking was underscored by many with only a slightly lesser number urging the value of the humanities for all young engineers.

Placement offices and their extensive functions as a service to students and alumni came in for a great amount of comment.

Strong Opinions

Strong opinions were voiced on what made for a good counselor and the remark "Avoid over counseling or poor counseling" appeared many times. Some alumni recommended that colleges employ full time professional psychologists or counselors but the majority seemed to feel that the most satisfactory type was found in the ranks of professors who had a broad outlook, a sympathetic interest in fellowmen, and a sound knowledge of industry through personal experience.

Covering as this study did, alumni from classes of the past ten years there is the chance that much has already been accomplished by American universities along the lines recommended. But whether that be true or not, it is helpful to know the weaknesses or fallacies in our counseling systems as now extant. Not many alumni can look back on their youthful years and say, "I did not need guidance." One of the greatest charms of youth is its willingness to listen (whether it acts as directed is often another matter) but the colleges, in serving as the training ground for young men and women, should assume the obligation of offering them the very best of guidance programs.

Integrating the Activities of an Agricultural Engineering Department in a School of Engineering*

By GEORGE A. MARSTON

Dean of Engineering, University of Massachusetts

I would like to make a few observations concerning Agricultural Engineering. In the first place, it is concerned with the applications of engineering principles to the agricultural industry, the largest industry in this country. The use of mechanical and electrical power, the design of farm structures, the development of processing equipment, and the planning of soil and water conservation are all a part of agricultural engineering. In practically all cases these problems have in the past been satisfactorily solved by using generally known engineering principles of electricity, the internal combustion engine, structural theory and the properties of materials. As a result, Agricultural Engineering has not demonstrated a need for or produced superior scientific knowledge. By comparison with Aeronautical or Chemical Engineering, other fields that are also relatively new among the family of engineers (and I speak as a Civil Engineer myself), we do not find that Agricultural Engineering has had to go to basic scientific research and to push back the boundaries of knowledge to find the tools necessary to solve its problems. Agriculture is the oldest livelihood of mankind. Many of its methods have been handed down from generation to generation. The opportunity to improve its procedures in our scientific age has been tremendous. Therefore, the Agricultural Engineer has found plenty of opportunity for practicing his profession almost without regard to his own scientific background. The result has been a tendency for Agricultural Engineering to be slow in advancing from the vocational to the professional level.

Breadth of the Field

There is another point that I wish to call attention to. Agricultural Engineering is a much broader field than either Aeronautical or Chemical. In fact, it is in many ways a more diversified field of engineering than any of the others, taking its structures from the Civil, machine design and the internal combustion engine from the Mechanical, farm power and equipment from the Electrical, and possibly food processing from the Chemical Engineers. Thus, it is unique among the family of engineers—sort of like the cosmopolitan child. This has its advantage but it makes Agricultural Engineering different—and to be different does not always win acclaim in our times!

I must certainly assume that most of you here today are interested in Engineering Education. You must recognize that Agricultural Engineering will not become a highly regarded branch of engineering until those of you in educational work put your own house in order. Service courses in refrigeration, farm motors, farm equipment and farm structures, without at least physics and mathematics as prerequisites,

* Presented at Annual Meeting of ASEE at Dartmouth College, June 26, 1952.

should not be called Agricultural Engineering courses. I suggest the term "Farm Mechanics" courses—however, call them what you will but not "engineering." The service offered by the "tire engineer" in the local garage is not far different from some of the work offered in these courses. That doesn't imply that they should not be offered for Agricultural students but don't confuse others with this engineering title. Agricultural Engineering curricula should include practically everything of the first three years of the Mechanical Engineering program: thermodynamics, applied mechanics, electricity, and of course all the physics and mathematics required of the other engineering curricula. In fact, I often wonder if Agricultural Engineering education shouldn't be at the graduate level, with a prerequisite a degree in M.E. or E.E. or C.E.—but let's leave that for future consideration!

Is Agricultural Engineering Needed

Some will question the possibility of attracting qualified students with such an undergraduate program. It has long been a problem of Agricultural Engineering curricula, and I doubt if it will be solved until your group "sell" themselves to the employers of engineers. Even the industries that manufacture primarily agricultural machinery have not been particularly vocal in expressing a need for this special kind of engineer. The trained civil, electrical or mechanical engineer with an interest in problems of agriculture finds himself with but slight handicap compared to the agricultural engineer. Possibly this is due to the poor scientific training some of our agricultural engineers have had in the past.

Now, with this background as I see it, what about the integration of the activities of an Agricultural Engineering Department in a School of Engineering? There are several "selling" points that make such a department a desirable addition to an Engineering School. In the first place, this field brings almost unlimited problems of the applications of engineering principles which can be suitable investigation projects for staff members of all departments and at all levels of professional background. Often the instructor or young assistant professor finds it difficult to get started on a research project which he feels has practical value and which has not been exhaustively explored before. Agricultural Engineering provides plenty of opportunity for the young engineer to practice his profession.

Furthermore, agricultural engineering brings a spirit of service which is not always found in other departments. The Agricultural Extension and Experiment Station work of the agricultural engineering departments tends to broaden the outlook of staff members. Consulting work is normally a part of the activities of the staff of an engineering school, in some encouraged and in others tolerated. Yet I know of no group that does more consulting work than the agricultural engineering departments through their extension activities. The fact that this is generally state- or federally-financed creates a spirit of service to the community at large that seems to me is more apparent in Agricultural Engineers than in others. There can be built up through the needs of this department a cooperative attitude on the part of all units of the School of Engineering.

Training and use of Staff

Other departments will readily accept the Ag. Engineer as part of the School if staff members are well qualified. Department heads have got to be aware that their colleagues in engineering schools are critical of the Agricultural Engineer who by training and experience and accomplishments is really a good farm mechanic —valuable as he may be. There obviously cannot be two standards of qualifications for the professional ranks in the same school—one for Agricultural Engineers and one for the other fields. This often means that the service courses for Agricultural majors will have to be handled by non-engineers, whose advancement ceiling

is lower than the engineers, or by instructors. Neither situation presents a serious problem if properly handled. I am convinced that the instructor who must offer refrigeration, for example, to dairy majors who haven't had physics will have to do a real teaching job. This experience will be fine if he advances to the professional subjects.

The occasional use of Agricultural Engineering staff members to handle engineering science courses, such as applied mechanics and strength of materials or engineering drawing and surveying, is a technique that can be used in integrating this department into the School. It can create a spirit of cooperation in the overall educational training of the engineers that will be most helpful.

Conclusion

Based upon five years of experience and a real interest in seeing Agricultural Engineering develop, I feel that the logical place for such a department is in a school of engineering. There are administrative problems involved but the ground is fertile for truely professional growth of Agricultural Engineering, which I am sure you all want.

College Notes

The story on the inclusion of philosophy courses in the **University of Detroit** curriculum announces an Arts College "invasion" somewhat unique in the history of engineering education. This is the first time an engineering college has placed such stress on philosophical principles.

* * *

Dr. Alfred W. Doll, Professor and Head of the Department of Physics at **Pratt Institute**, has been named Acting Dean of the School of Engineering to succeed H. Russell Beatty. Dr. Doll received his education at the University of Pennsylvania, Columbia University, and New York University. He is active in the ASME, the American Institute of Physics, ASEE, and Tau Beta Pi. He has been a member of the faculty of Pratt Institute since 1925, and has headed the Physics Department since 1938. Mr. Beatty, who has been at Pratt since 1937, will assume the Presidency of **Wentworth Institute** in Boston on July 1. He is a graduate of the University of Maine and New York University, and an experienced management engineering consultant. He holds membership in ASME, ASEE, and Tau Beta Pi.

Two new engineering buildings were dedicated on March 26, 1953 at the **Agricultural and Mechanical College** of Texas. These were a Texas Engineers Library building and an engineering classroom and laboratory building.

* * *

Appointment of Dr. Albert G. H. Dietz as Acting Head of the Course in Building Engineering and Construction at the **Massachusetts Institute of Technology** has been announced. Beginning July first the course will operate as part of the Department of Civil and Sanitary Engineering and its instructing staff will be included in this department.

* * *

Appointment of Dr. William A. Patterson as dean of engineering at **Fenn College**, Cleveland, Ohio, has been announced. Patterson, Fenn registrar since 1946, was appointed associate dean of engineering in February last year after former engineering Dean G. Brooks Earnest became Acting President.

Distinguished Professor at the University of Kentucky

By M. M. WHITE

Dean, College of Arts and Sciences, University of Kentucky

The problem of recognizing merit and holding personnel is met in all professions and in all fields of industry. Financial reward is always but one of many factors determining a man's choice of jobs and in our Universities it is a relatively weak element. Fortunately, opportunity for service, security, and recognition are desired more than material gain. Were this not true, we could not hope to hold our outstanding young men for we cannot compete with government or with industry in monetary inducements. As a recognition of service and ability the College of Arts and Sciences of the University of Kentucky elects each year from its membership the "Distinguished Professor of the Year."

Privileges and Obligations

The honor allows the man elected to have one semester on full salary free from all academic routines. It permits him complete freedom to develop his interests in his own way. He may spend the semester in his laboratory; he may gather research material in far places; he may go around the world; he may write a book in Florida or in California. During the nine years that we have had the program each of these things has been done by some professor.

Following this semester the professor must deliver to his colleagues and the public a lecture based on his voluntary activity. Every effort is directed to make this lecture and the reception following it an occasion of interest to the academic community and of honor to the Distinguished Professor. A printed statement of the professor's personal history and election to the honor, with mention of the title and date of the lecture, is mailed to approximately four hundred individuals in other institutions. This list varies from year to year, being comprised mainly of persons interested in the field of the lecturer.

Method of Selection

The Dean of the College of Arts and Sciences appoints a committee of five staff members of professorial rank to conduct the election and arrange for the lecture. Usually staff members who have previously held the honor constitute the majority of committee members.

In the spring, the committee sends to each faculty member a request for one nomination selected from a list of all individuals holding professorial rank without administrative duties. The request is accompanied by a list of eligible persons, a list of professors previously honored and a short statement of the basis upon which nominations are to be made.

After the nominations have been received a ballot listing the highest three or four nominees is sent to the voters. If other ballots are required to give one nominee a majority, the nominee receiving the fewest votes on a given ballot is dropped from subsequent ballots.

When one candidate has received a majority of the votes, he is so informed by the chairman of the committee. He then makes arrangements with the Dean to be released from his usual duties during the

fall semester and selects an approximate topic and date for his lecture to be given during the spring semester.

Functions Served

1. The Distinguished Professorship promotes the prestige of the *teacher* among the University personnel. During the nine years that we have bestowed this honor the recipient has always been a man whose teaching ability was rated high by his colleagues. Research has played its part in the choice but has not been the primary factor in selection. You have probably noticed that a member of a University Faculty, asked by a stranger what he does, is more apt to say that he is a physicist, an engineer, or a psychologist than that he is a teacher. Isn't this because he prefers to identify himself with the group which he thinks has the higher prestige? Yet we have great faith in the value of the teaching profession; we make sacrifices—certainly financial ones and often others, too—to belong to that profession. There is delight in occasionally producing a really outstanding student. There is pleasure in having a good or average student thank you for what you have contributed to his learning whether by inspiration or by solid factual material. All of us have enjoyed these intangible values. But public recognition brings a zest of its own.

2. Election to this honor gives security and pride of accomplishment to the recipient. It is an honor given by one's colleagues with a secret ballot. Administrative approval, increase in salary and rank, offers from other Universities are desirable but this indication of confidence by fellowworkers is something quite different and probably more pleasing.

3. Not only the immediate election but the knowledge that there is to be one each year encourages faculty members to know and appreciate workers in other fields. In this age of specialized training and departmental organization, we must strive constantly for cross fertilization of ideas from many departments.

4. Although the Administration has nothing to do with the election of the Distinguished Professor and little to do with the implementation, it receives benefits also. Members of the Administration see individuals from a different and unfortunately limited point of view. Knowing the evaluation of a man by his colleagues is of great value.

Another advantage to the Administration is that destructive criticism may be reduced and scapegoating (with the Administrator the goat, of course) may be decreased. Constructive criticism is, of course, a very different matter.

5. A final and important advantage of the Distinguished Professorship is the Faculty participation in important decisions. To participate in the election gives a feeling of belonging to the group. Each individual is a vital part of the whole.

The whole program of the Distinguished Professorship depends by its nature upon faculty initiation, interest and activity. Such a program implemented by the Administration would be without meaning—or at least of very different meaning.

Anything that will increase the active participation of the professor in the determination of the policies of our college is valuable. One is constantly delighted with the rich, lively, and exciting inventiveness and ingenuity of the so-called absentminded professor.

The Role of Professional Licenses in Engineering Education*

By EDWARD J. NUNAN

President, New York State Society of Professional Engineers

Those men who are about to embark upon Engineering as a career must expect inevitably to face the matter of a professional license. All 48 of the States as well as the District of Columbia now have a Professional License Law and the earlier in his career he obtains this license the better off he will be in the end. While it is true there are a few exceptions where licenses are not required, such as Federal employees, certain State and Municipal employees, employees of Corporations engaged in interstate commerce, employees of Corporations under the jurisdiction of a State Regulatory Body and individuals working under the direction of a licensed Engineer, it is my opinion that many of the exceptions are rapidly becoming outmoded. As a matter of fact I know that one of the largest Corporations in this country has decided upon a policy that will not permit any of their Engineering employees to be designated by the title Engineer nor will they permit them to do any Engineering design or construction which has to do with the safety of the public unless they have a Professional License. Many State, County and Municipal jobs now have a Professional License requirement. As a matter of fact the New York State Department of Public Works does not permit a man to take the Civil Service Examination for any grade including and above that of Senior Civil Engineer without a professional license even though he may have a college degree. Many members of the Department of Public Works who have had long employment and neglected to get their professional licenses are barred from promotion because at this late date they will not take time to study and prepare for a professional license examination.

Increases Stature

A professional license always increases a man's stature even though he may be holding a position which at the time does not require a license. It has benefited Engineering education through the necessity for accrediting Engineering College. Men graduating in law and medicine are required to take their license examinations immediately upon graduation from school, why not the Engineer.

New York is one of the states which has established a plan under which graduates from registered courses may take their preliminary examinations when they are best fitted to do so. Under this plan they may take parts one and two of our examination immediately upon graduation. These are the preliminary examinations and upon passing them the man is granted a certificate as an Engineer in Training. After completing four years of experience of a grade and character satisfactory to the board, Engineers in Training may then take part three. This is the final examination for license and upon passing it the man is granted his professional license. This plan was adopted to permit young Engineers to be examined in the basic

* Delivered at the Middle-Atlantic Section Meeting, A.S.E.E., at Manhattan College, Dec. 6, 1952.

principles of the profession while their training is still fresh in their minds. Previous to the change in this law, no one was permitted to take any of the examinations until they had acquired four years of satisfactory experience at which time they were permitted to take all three of the examinations. Under the new system a much higher percentage of candidates pass than in the cases where they took the entire examination at one time, after being out of college a minimum of four years. Those students who graduate in Engineering and expect to follow Engineering as a profession will eventually have to face the matter of a professional license and the time to take that examination for a license is immediately upon graduation.

The New York State Society of Professional Engineers as well as the National Society are doing everything within their power to see that men graduating in Engineering Courses are given all the information necessary to enable them to obtain their licenses. In many cases we do not have the opportunity to reach all of the students who should be so advised and it seems to us the proper way to handle this is through the Engineering Schools themselves. Many men are now graduating without knowledge a license is necessary. I can think of no group of Engineers who should be more interested in the future of the Engineering Profession than those doing the teaching in our colleges today. They above all should be as much interested as any one in an Engineering License Law and its strict enforcement. In addition they have the complete confidence of all of their Engineering students and they above all should be the ones who should stress the advantages of an Engineering license and the methods of obtaining one. I know that here at Manhattan College and at many other schools a great deal of effort is put forth to instruct the students as to the method of obtaining their license and also advised as to the E. I. T. licenses, when the examinations are to be held and give them every encouragement and advice as to what they will have to expect in the nature of an examination. I am firmly convinced that every Engineering School in the country should follow these lines of thought. It is the hope of our Society that eventually all of those teaching Engineering in colleges will recognize the importance of obtaining a license of their own and in this way impress upon all of their students the benefits to be derived from a professional license which in turn will make Engineering the profession it deserves to be.

Unionism

There are many more advantages to be gained by having a professional Engineer's license or an E. I. T. certificate in that it serves to protect our profession from the restrictive practice of Unionism when its productivity must be greater than ever before, and it is the thought of many Engineers in Industry that if all of those men graduating in the profession had an E. I. T. Certificate when they apply for employment the Union problems would be much easier solved. The Taft-Hartley Act of course eliminates anyone with a Professional Engineering license from having to join any collective bargaining unit. I am firmly convinced that with proper education this can also be made to apply to the E. I. T. The policy of the National Society of Professional Engineers regarding collective bargaining by professional employees is as follows:

"It is definitely unprofessional for a Professional Engineer professionally employed voluntarily to join a heterogenous Union dominated by or obligated to nonprofessional groups. The individual responsibility and independent judgement required of a Professional Engineer are incompatable with the regimentation fundamentally inherent in Unionization. Nothing in this statement shall be construed as a criticism of Engineers who may be forced to join a labor union against their will but Engineers in this predicament should seek to extricate themselves by due process of the law.

"Nothing in this statement of principle shall be construed as a criticism of Engineers in Training who voluntarily join a labor union when as a step in their practical Engineering training, they are temporarily

employed in nonprofessional or subprofessional work where their fellow workers are organized. When promoted to professional responsibilities however, the Engineer cannot continue in his labor union affiliation without sacrifice of professional status."

Much trouble has been experienced along these lines and one large industry that I know of has, at present, a strike which is forcing many E. I. T. men to be temporarily unemployed through no fault of their own. I would like to stress at this point that these men are not forced to join a union. However, unless they are engaged in a supervisory capacity or in a very special job they become automatically a part of the office force of this organization which is controlled by a Union comprised of office workers. This Union comprises all of the office help such as stenographers, file clerks, blueprint machine operators, office boys, etc. In other words, it is a bargaining unit which comprises the entire office force of this organization outside the few of those employed in a supervisory capacity and of course includes those young Engineers who are employed in various sub-professional jobs and in Training Courses. As I said before it is not necessary for these young Engineers to join the Union; nevertheless they are a part of this bargaining unit and whether they join or not they are automatically a part of it and to a large extent controlled by it and if a strike is called they are out of employment also. Some of the Engineers have E. I. T. Certificates, others, do not although they do have a College Degree in Engineering. Again all are subjected to the high pressure tactics of various Union leaders and under these conditions are apt to get some erroneous ideas of their future.

Conclusion

For the reasons I have stated I believe that if all Engineering graduates had an E. I. T. Certificate when they applied for employment that we then might be able to do something for them. Our Engineers, due to their training, should be building toward future positions where their own individual imagination, abilities, and initiative will enable them to take over an executive position. Certainly there is no place for this type of thinking in any collective bargaining group.

Forty per cent of industrial management is Engineer trained replacing both the lawyer and the banker in top industrial posts. Engineering is and no doubt will continue to be our country's third largest profession.

We in the National and State Societies of Professional Engineers are endeavoring to do everything that we can to increase the professional conscienceness, ideals, and rewards for the Professional Engineering Career. We cannot do it alone. You, gentlemen, charged with the education of our future Engineers can do a great deal to help the profession. With your cooperation I am sure we will be successful.

College Notes

To bring industrial engineers current information in the rapidly expanding field of transistors, the **Massachusetts Institute of Technology** will offer a Special Summer Program in Transistors and Their Applications from July 20 to 31 during the 1953 Summer Session. The aim of the program, announced by Dr. Ernest H. Huntress, Director of the M.I.T. Summer Session, will be to define those areas in which the transistor may have immediate application and to make some prediction of its future. Approximately one-fourth of the M.I.T. summer program will be devoted to a development of the theory of the operation of transistors, starting from familiar physical principles.

Training in Research*

By FREDERICK C. LINDVALL

Chairman, Division of Engineering, California Institute of Technology

The colleges and universities of the world during the past hundred or more years have provided an environment which has led to nearly all of the fundamental science upon which our present-day technology is based. With very few exceptions, the great names in science and the discoveries and principles with which those names are associated are those of professors and their students in the colleges and universities. Does current sponsored contract research conform to the academic objectives of training of students and the production of new knowledge?

Industrial research and government laboratories contribute to the search for basic knowledge, but in view of the principal objectives of the laboratories of this type, we must expect them to be directed toward application and development and, therefore, we must continue to look to the colleges for our major advances in fundamental science. This in itself is sufficient reason for emphasis on research and upon the training in research which comes through the efforts of the professors working with their graduate students. These academic research efforts, in the past unorganized as they were and often poorly supported, have been successful both in output of useful results and in the inspiration given to students to continue the quest for knowledge. This method in basic science is a priceless asset which we must support and at the same time must protect against the encroachment of development work with its inherent direction. As Dr. Conant has said: "There is only one demonstrated method of producing basic knowledge; that is, by picking men of genius, backing them heavily, and leaving them to direct themselves."

A second reason for research in colleges is that teachers who engage in a reasonable amount of research maintain their professional effectiveness and inspire their students with the spirit of freedom of inquiry.

A third reason, which is intimately related to the first two, is that the students learn research, its spirit and techniques by seeing research done and by participating in the research program, first as aides or apprentices, and then as advanced graduate students working as nearly as possible as independent investigators. Additional reasons for doing research are those of public service to the local community, to the state and the nation, of assistance to the military, of cooperation with industry, —all of which are valid under qualifying circumstances, but which are sometimes invoked as justification for work which might be better called "engineering development."

A Learning Experience

Training in research is a learning experience, perhaps more subjective than some of the more formalized courses of study, which involves an awakening of curiosity and a spirit of inquiry, coupled with methods and techniques. This spirit of research and the leadership which fosters it are prime factors in research training: problems, facilities, organization are secondary. A real investigator with "sealing wax and string" equipment can give

* Presented at the Annual Meeting, A.S.E.E., at Dartmouth, June 26, 1952.

a student far more than could be had from some types of elaborately implemented group effort rightly referred to as "organized mediocrity." The same good leadership can bring out for the student facets of a problem which are contributions to basic science, although the objective of the problem, itself, may be applied research or development. A Langmuir might develop a dishwashing process and yet concurrently make vital contributions to basic knowledge of surface physics and chemistry. The man who is doing the work has as much to do with the character of the research as the specific stated problem.

Sponsored research in colleges today has reached enormous proportions. Some of this work has little or nothing to do with the academic program. In many instances, it is harmful to the teaching program because it dilutes the efforts of the teaching staff and brings to the campus full-time employees who do no teaching and occupy space which is then not available for normal graduate student use. Frequently, large-scale projects operate under military security in separate buildings and those members of the faculty who must spend time there are virtually inaccessible to the students. Other classified projects in the regular campus buildings are objectionable because they require the blocking off or isolation of corridors or wings, and individual rooms bear the inhospitable notice, "Restricted Area—No Admittance." Such activity is not in the spirit of academic freedom, of discussion, publication, or interchange of ideas. Except for a few who may be employed as part-time workers, students simply do not have access to this work, do not see the research in progress, and cannot be told about it by the professors. Such projects teach no research.

Fortunately, better sponsored research can be had if discrimination and determination are used in the acceptance of contracts so that work of fundamental and basic type can be done freely on the campus without restriction on publication or use of graduate students. Such sponsored work can provide the equivalent of graduate research assistantships, actually compensation for services rendered on those government funds which do not permit scholarship grants. Such association with research projects can be real research training, if the work is done by the faculty members and their students in the best academic tradition, rather than as an highly organized effort with administrative procedures inappropriate to academic life.

High dollar value of the research contract need not lead to an excess of administration. One of the largest contracts in Physics at the California Institute of Technology—approximately $100,000 a year—includes a variety of studies in nuclear physics with no administrative machinery at all. The responsible professors are to be found not in their offices, but in the laboratory and, except for age, are indistinguishable from the graduate students. This effort has been highly successful in its output of fundamental knowledge.

Another type of sponsored research on the CIT campus operated for several years with highly organized administrative procedures. The professors involved spent most of their time "directing" research, rather than participating in it. The equipment was elaborate and the work was done almost entirely by full-time non-academic employees. The whole atmosphere was inhospitable to graduate students, although they were encouraged to participate in the work. Instead students preferred to work on other things directly and intimately with professors in the personal, informal way in which academic research developed, rather than in the impersonal, organized directed effort. We have subsequently substituted some anarchy and chaos for this particular organized administration, encouraging the faculty members to work directly with their projects and are now successfully integrating graduate students with the several programs.

Over-expansion in Staff

The availability of money for sponsored research, particularly from government sources, has tended toward over-expansion in staff and facilities in the colleges. In many of our schools the best teachers and research men have become so involved in project work that too little time is available for the personal student relationships which are needed for the best research training. Some colleges have used project money as a way of augmenting faculty salaries to hold personnel. Conversely, in order to meet project commitments, new personnel have been employed, sometimes with the added inducement of a faculty position for its prestige value, with or without any teaching. The tenure commitments, stated or implied, to these new faculty members may present serious problems for the future, as project money becomes less readily available.

Just as the faculty salary schedule inflated with contract funds is a serious problem, expansion with elaborate facilities is potentially hazardous. Large apparatus, such as wind tunnels and water tunnels which require crews for their operation, certainly are luxuries no college can afford if government support is not available. The fact that these facilities are government properties, which probably could not be removed, imposes some obligation on the schools to make them available for government work which, in the absence of easy project money, will be on the government's terms. The colleges may find themselves with operating contracts for the performance of work which is planned and directed by some government agency. Moreover, these larger facilities are difficult for graduate students to use, even under present funding possibilities, so that, unless the work is very carefully plannned with the student's interest in mind, little of value in the teaching of research will accrue to the student. He may find employment which will help him maintain himself in school and he may learn some things by osmosis, but he will lack that essential feeling of participation and the opportunity to follow some line of inquiry which is his own.

At the California Institute of Technology, the Division of Biology, unhappy about student participation in sponsored research, has stated that graduate students may not be employed on sponsored research, but instead be granted scholarships which will permit them to pursue research which is simple, self-contained, and individual in character. The spirit behind this principle is that a student sharing in a sponsored research program with other students and under faculty supervision will not have the opportunity to use his own initiative and develop as a well-rounded research man. The rest of our campus does not share completely this belief, but recognizes its merits.

Summary

In summary, it may be stated that sponsored research which does not integrate with the fundamental objectives of an academic institution in the furtherance of basic knowledge and the teaching of students is out of place on a college campus. Uncritical acceptance of sponsored projects may lead to poorer teaching and mediocre research. Wise use of the opportunities for sponsorship allows the colleges, working beyond their own resources, to meet their responsibility, far more effectively, for the search for new knowledge and the training of new research workers.

TIMELY TIPS

The Optional Problem—A Teaching Device

By WILLIAM K. VIERTEL

Instructor, State University Agricultural and Technical Institute, Canton, N. Y.

One of the most serious criticisms made of modern education is that it often leaves the superior student unchallenged while the instructor gives most of his efforts to the average students who make up the majority of his classes, particularly at the freshman level. The device of the optional problem is one way in which superior students can be stimulated to do their best on work which challenges them. The writer has used it successfully over a period of ten years, in various technical courses.

Optional problems may be assigned whenever the situation is ripe for them. This may be when the topic involved is taken up in class; or it may be when suitable motivation arises. It is explained to the class that the word "optional" means what it says: students do the problem or not, as they wish. There is no penalty for not attempting it, and no penalty for attempting it and getting it wrong. For anyone who gets it right, appropriate credit is given. It may be added that students who can do these problems usually do not need any extra credit. A reasonable time is allowed to get the problem done, remembering that students have their regular work to do, in this and in other courses.

It is required that students append to the solution, when submitted, a signed statement that the work has been done honestly. The reason for this is mostly psychological. The writer has examined several hundred papers on numerous different problems, over a period of years, at two different colleges (one of which had the honor system and one did not), and has yet to see any attempted solution of an optional problem which did not bear the unmistakeable stamp of the personality of the student who submitted it.

Optional problems must be carefully selected, and should not be given too often. The ideal optional problem is one which very few students are likely to get right, so that they will have a feeling of something unusual achieved if they succeed. The writer has always insisted on extra-high standards of accuracy and neatness in these problems. Errors in reasoning or computation, or careless presentation, cause rejection. Errors of judgment, in some cases, are considered permissible. An example of a problem of this type is included below.

The enthusiasm with which superior students attack these problems is a continual surprise to the writer. He considers this proof, if any be needed, that students do accept their share of responsibility in the educational process, and will respond to a challenge. Students have said to the writer, "These optional problems are aggravating. I get interested in them and spend so much time on them that I don't get my other work done."

Following are a few examples of optional problems the writer has used in teaching freshman engineering mathematics.

(1) A stone is dropped in a well, and it is found that exactly 4.0 seconds (by stop-watch) elapses between the dropping of the stone and the time the

splash is heard. Assume 1100 ft./second as the speed of sound. Calculate the depth of the well.

(2) A well-known parlor game is to ask someone to write down a three-digit number. (The first digit must not be the same as the last.) Have them write the number, reversed, immediately above or below the original number. (See example.) Subtract the two. Then write the difference, reversed. Add the last two numbers. The result is always 1089.

```
  712
  217
  ---
  495
  594
  ---
 1089
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The problem is to give a general proof that the result is always 1089.

(3) A car travels d miles, from Smithtown to Jonesville, at an average speed of 40 miles/hour. It makes the return trip at an average of 60 miles/hour. Find the average speed for the round trip.

It was on this problem that an error of judgment was considered permissible. If a student worked with decimals instead of common fractions, his answer did not come out exactly correct.

(4) One of numerous devices to convert Centigrade temperatures to Fahrenheit, *or* the *reverse*, is to add 40 to the given temperature; multiply by 9/5 in the first case or 5/9 in the second; subtract 40 from the result. Example: convert 40° Centigrade to Fahrenheit. Add 40, giving 80. Multiply by 9/5, giving 144. Subtract 40, giving 104° F.

The problem is to prove that this method is theoretically sound.

(5) Derive the rth term of the binomial expansion $(a+b)^n$. Can be used only if the text-book used does not give this.

(6) Explain in terms of logarithms the use of the right index of the slide rule in multiplication.

(7) Prove that

$$\log_b a = \frac{1}{\log_a b}$$

(8) Prove the formula for $\sin(A+B)$ and $\cos(A+B)$ if either A or B is greater than 90°. (Various cases.)

(9) Prove that

$$\sin A + \cos B = 2 \sin\left(\frac{A-B}{2} + 45°\right) \times \cos\left(\frac{A+B}{2} - 45°\right)$$

(10) Given a regular tetrahedron, edge 2. Let a plane be passed through one edge of the tetrahedron in such a way as to bisect the tetrahedron. Find the angles of the triangle so formed.

(11) Calculate how to lay out a sector of a circle so that when formed into a cone it will have any given base radius r, and any given altitude h.

College Notes

A plan to aid industry through fundamental research in engineering and science has been devised at **Carnegie Institute of Technology.** A regular and scheduled information service has been set up by the institution. This information service makes available to cooperating companies reports on current research projects undertaken by individuals of the engineering and science departments. Cooperating companies are those organizations which give financial support for research to Carnegie.

THE T-SQUARE PAGE

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DEVOTED TO THE INTERESTS OF ENGINEERING DRAWING

JOHN M. RUSS, *Editor*
State University of Iowa

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January 2, 1952

Prof. B. L. Wellman
Worcester Polytechnic Institute
Worcester, Mass.

Dear Prof. Wellman:

Your report of the East Lansing meeting, including as it did your invitation for expressions of opinion, has prompted these remarks. Having spent three years teaching engineering drawing and nine as a design engineer in varied industries, I feel that my views might be of interest to men currently engaged in teaching.

Are integrated drawing courses more pedagogically sound and more efficient of time?

I am not certain what is meant by an "integrated" course but I presume that this means, for example, that structural drafting should be taught by the civil engineering department in conjunction with the structural design courses rather than as a drafting course given by the drafting department. If such is the case, my answer would be "No."

There is almost irresistible tendency for the mechanics of drawing to become secondary to the theory involved. Drawings degenerate in time to sketches on quadrille paper. In such a course, the final examination almost invariably stresses the theory which has been studied. It is difficult to test a student's improvement in drafting ability by a mere final examination. Only a drafting course which lays heavy emphasis on the grades for the drawings submitted serves to drive home the idea that the development of drafting skill of a professional caliber is one of the prime objectives of engineering training.

How can we convince the administrations that descriptive geometry is a vital part of an engineer's education?

I have of course encountered dozens of situations where my knowledge of descriptive geometry saved the day. But more important, I have also had several dramatic experiences where a design problem was mauled by so-called design draftsmen and where the office fat was pulled out of the fire by an engineer who had mastered descriptive. These instances, although they do not occur daily in an office, occur frequently enough to cause run-of-the-mill draftsmen and unappreciative employers to hold their graduate engineers in greater esteem.

Most schools offer only one semester of descriptive geometry. At the City College of New York, where I was an instructor from 1946–49, two semesters of descriptive were required; this, I feel, fills the need of our future engineers more adequately.

What to do with students who have had drawing in high school?

My feeling is to ignore this superficial training and require these men to do the same work as those students entering with no previous training in drawing. I say this because I numbered among my students many graduates from a local technical high school which has a national reputation. These students had four years of drawing training in high school and openly expressed resentment upon being informed that they would be re-

quired to take the regular college course. I have heard such expressions in my classroom during the first few meetings and I used to deal with these dissidents by directing leading questions to them in the course of the first few lectures. After repeated confessions of ignorance, the smoldering resentment was dissipated and the boys buckled down to do a swell job.

The fault of course did not lie with the boys. I attributed the blame to their high school teachers who had led them to believe that high school training in mechanical drawing is the equivalent of college training in engineering drawing. Until I see dramatic proof to the contrary, I will continue to reject that idea. The principal reason why high school training cannot match the caliber of college training is that high school drawing is necessarily confined to simple objects requiring no preparation in descriptive geometry, and secondly, high school teachers generally do not have the close connection with the preparation of engineering drawings that the college teacher has had.

As a means of convincing the administrations how important engineering drawing is (I would suggest that the deans organize seminars and conferences with leading engineers in the community at which time they can discuss the general question, "How can we train our young engineers to turn out professional-looking drawings?" Interest should be high because almost all offices pride themselves on their drawings. The expressions by practicing engineers will do much to convince the deans and presidents that drafting ability and mastery of descriptive geometry represent for engineers, not merely mechanical skills, but necessary professional skills.

The importance of drawing itself in relation to the professional status of engineers.

We have witnessed in recent years an attempt by some educators to relegate engineering drawing to a back seat on the campus. The result is that very few colleges, if any, can point to their graduates and say, "There is a group of young engineers who can step into any drafting room and do the professional job that is required of them." I have witnessed dozens of times the almost tragic first effort at drawing by a young graduate from an accredited college. Viewing the grossly amateurish first drawing, the employer feels justified in offering the young engineer the meager salary which is current, because the average youngster simply cannot pull his own weight in the office.

It seems to me that in this connection we engineers ought to borrow from the medical schools. One never hears of a young medical graduate being unable to tie a bandage, administer a hypodermic, perform simple surgery, etc. The lay public cannot differentiate between young and old doctors in the performance of elementary professional skills. The same ought to hold true for engineers. Our young graduates should be able to turn out professional looking drawings as well as the older, experienced men. Until such time, the status of the young graduate in an office, for several years after graduation, will be below that of the technical school-trained draftsman working next to him. And his salary will be, and is, correspondingly lower.

Those of us who are concerned with advancing the profession both economically and socially must keep in mind that unless we succeed in turning out a better college product, starting salaries in the profession will continue to be below that of current union rates for common labor. It will continue to require fifteen or more years of professional experience until the engineer achieves a financial status commensurate with the services he renders.

An engineer who cannot put his design down on paper in conformity with current drafting standards can do only half a job. Let us train our students to do a whole job.

Very truly yours,

David Singer

Minutes of Executive Board Meeting*

A meeting of the Executive Board of the American Society for Engineering Education was held on Monday, April 20, 1953, at the Northwestern University, Evanston, Illinois. Those present were: W. R. Woolrich, *President*; M. M. Boring, J. H. Lampe, E. A. Walker, W. C. White, *Vice Presidents*; C. L. Skelley, *Treasurer*; A. B. Bronwell, *Secretary*; K. B. McEachron, Sr.; and B. R. Teare.

Annual Meeting

The Secretary reported on the progress of Society activities and the plans for the Annual Meeting.

Nominating Procedure

The procedure for nomination of officers was discussed by the Board. It was suggested that the balloting procedure is not too well-known to the membership and that a summary of this procedure might be published in the May issue of the JOURNAL.

Quarterly Report

The Treasurer presented the statement of Receipts and Disbursements for the third quarter ending March 31, 1953. It appears that the income for the year will be from $2,000 to $3,000 over budget. Expenses will also be higher than budget, owing to an increase in printing costs of the JOURNAL OF ENGINEERING EDUCATION, the rising cost of supplies and sundry printing, etc. The hiring of an assistant secretary and an additional office secretary, as well as salary increases, have increased costs of operation. It appears at present that the expenses will be very close to income for the current year, although there may be a deficit. The financial outlook for next year is somewhat better, owing to the success of the Associate Institutional Membership drive and the increased advertising revenue.

Report on Growth of Engineering Unions

Mr. Karl B. McEachron, Sr., General Electric Company, presented a summary of the problem facing the engineering profession, resulting from the growth of labor union activities in this field. He discussed the positions taken by EJC and NSPE in testimony before Congressional Committees, relating to amendments to the Taft-Hartley law. He stated that Engineers' Joint Council had refused to include in its testimony the advocacy of the principle of "Freedom of Association" which would give the engineers an additional degree of freedom through operation in company associations. He emphasized the fact that the present Taft-Hartley Law draws an Iron Curtain between management and labor which is not in conformity with professional precepts. He also stated that labor unions cannot long survive without expanding their activities into other areas of interest to engineers and that this would ultmately result in their attempting to take over the technical programs and building themselves up as a "Unity Organization" for the profession.

He reviewed some of the plans under consideration by his company and other companies for developing organizational channels, improving the professional status of the engineers, and improving their working conditions and facilities. This will be the subject of the Tuesday morning General Session.

Several points were raised by Board Members. It was pointed out that a substantial number of engineering graduates, probably those most vulnerable to unionization, are not associated with engineering societies and therefore are not reached by activities of the engineering societies in their attempt to forestall the growth of unionism. It was also pointed out that

the lack of spread in the salaries of engineers is cause of considerable discontent, since beginning engineers are hired at salaries not too much lower than those of engineers of 10 to 15 years experience. The greatest impact of unionism on the engineering profession would be a leveling down process which would destroy individuality and outstanding achievement. Also, the better men are inexorably "swallowed-up" in the process of unionization, regardless of whether they want it or not.

An article written by President Woolrich on this subject, entitled "The Engineering Profession—Leveling off to Mediocrity or Ascending to New Heights" was published in the April issue of the JOURNAL OF ENGINEERING EDUCATION. This article was forwarded to the Engineers' Joint Council to be sent to all members of the Engineering Manpower Commission. The National Society of Professional Engineers published this article in their Journal. Also copies were sent to the Deans of Engineering Colleges, since the projected plans of the engineering union organization contemplated setting up student organizations in engineering colleges.

Engineers' Joint Council

The question was raised as to the procedure used by EJC in formulating its policies and presenting testimony before Congressional Committees. It was pointed out that EJC cannot properly represent the Engineering professions unless all major policy matters are referred to the societies for their study and actions. Otherwise, the Unity Organization becomes a separate entity with opinions of its own, independent of those of the constituent societies.

Society Organization and Function

Dean Teare, Chairman of the Committee on Society Functions, was invited to attend the Executive Board meeting, since the Board had decided to devote this meeting to thinking ahead in problems relating to the Society organization and function. Dean Teare presented a progress report on the preliminary thinking of the Committee. The main concern of the Committee is to study the Society operations with a view toward improving its organization and functioning. Dean Teare mentioned that the Committee has divided the main problem into four parts, assigned to subcommittees for study. The reports of the Sub-Committees will be carefully considered by the Committee on Society Functions either prior to or at the time of the Annual Meeting. It is expected that this study will carry on into next year.

Dean Teare enumerated the following factors which the Committee on Society Functions has under consideration:

1. *Diversity.* The Society organization has grown in many divergent directions and there seems to be need for a careful review of the Committee and Division Structure so as to achieve better coordination and minimize duplication of effort.

2. *Flow of ideas.* Many of the principal Society projects have been suggested by officers of the Society. Although some worthwhile projects have been initiated by Committees and Divisions, there is need for more activity in this direction. It has been suggested that if the Division and Section Chairmen are made members of the General Council, a closer working liaison would be established between the General Council and the operations in Divisions and Sections.

3. *Increasing the effectiveness of units of the Society.* The problem of increasing the operational effectiveness of the various Divisions, Committees, and Sections of the Society is being considered by the Committee. One of the principal problems seems to be that of travel expense. Experience has shown that Committees which meet at reasonable intervals achieve a higher degree of success and accomplishment than those which meet once a year at the Annual Meeting. On the other hand, travel appropriations can be costly as pointed out by the fact that the travel expense of the other major engineering societies equals more than half the total ASEE Annual Budget.

4. *Size, composition, and function of the General Council and Executive Board.* This is a problem of studying the optimum organization and lines of administrative control with respect to the Divisions, Sections, and Committees in order to achieve close cooperation and efficient operation. The problem also consists of studying ways in which the most competent people can be inducted into Society activities and moved along into administrative positions.

5. *Service to the individual member.* This consists of a study of the scope of operations of the Society as it pertains to the benefits derived by the individual member. This problem is related to costs of operation, since the providing of extensive collateral services to individual members requires adequate Headquarter staff and increases the operational expense. A phase of this study will be that of the role of Summer Schools and Branches in the Society's program.

Dean Woolrich emphasized the dangers of embarking upon a program to pay travel expenses of Society members to attend Committee meetings, pointing out that most of the Societies have large travel budgets which consume a very substantial portion of the dues of the individual members. Once a travel budget has been expanded, it is virtually impossible to contact it.

The Secretary suggested that arrangements be made to hold meetings of ASEE Committees and Executive groups of the Divisions at the time of the Fall meetings of the ECAC and ECRC. These meetings have grown in importance and attendance and they could provide a common meeting ground for ASEE activities. This would give Committees and Divisions an opportunity to formulate their activities for the year and get off to an early start. This plan was approved in general principle by the Board.

One of the principal problems in the Society operation is that of getting the most competent people assigned to the principal Society functions. It was suggested that President Woolrich send a letter to the Chairman of Divisions urging them to give this matter careful consideration and to plan their nominations of Divisional officers sufficiently far in advance to make a careful study of the possible candidates and their qualifications.

In outlining the current operation of the Society, the Secretary stated that the Divisions, Committees, and Sections were allowed considerable latitude in their operations. The Secretary's office attempts to maintain a liaison between the various units and keeps them informed on major Society activities through the President's Newsletters, the JOURNAL and other media. The limited size of office staff makes it necessary to focus much of the attention on the principal Society projects and follow these through to maturity. An increase in office staff has been necessary in order to handle the rapidly growing activities of the Society. At present the secretarial staff is seriously overloaded and a further increase seems inevitable.

Dean Walker stated that there are a number of areas where the ASEE should take an active role in arranging conferences, such as instrumentation, electronic computers, etc.

The possibility of coordinating the program of the Section meetings with the national activities of the ASEE was discussed. This might be accomplished by arranging sub-groups in the various Sections which would cooperate with the Divisions and Committees of the Society, thus providing for a flow of ideas into the Sections as possible material for Section programs.

Dean Lampe advised against turning the Section meetings into a National meeting, stating that many of the Section meetings have a high degree of individuality and purpose of their own which might be destroyed by attempts to control from above.

The Executive Board discussed various proposals which have been advanced for improving Section operations by either relocating Section boundaries in order to shorten travel distances or by instituting Sub-Sections within the present frame-

work of the Sections of the Society. It is believed that a reduction of travel distances would increase attendance of the younger faculty members at Section meetings. This problem will be referred to the Sections for their consideration.

Dean Woolrich urged that each Section consider establishing a committee to develop relations with industry in its geographical area. The highly successful operations of the Division of Relations with Industry has demonstrated what can be done in this field of activity. The Relations with Industry Division has offered to cooperate with any Section of the Society in this type of operation.

It was pointed out that the Summer School programs might be improved by increasing the amount of time devoted to them, so as to make it possible to explore the curricular areas more deeply.

Dean Teare mentioned that one of the proposals under consideration by the Committee on Society Functions is that of electing the President one year in advance and having him serve as an ex-officio member of the Executive Board so as to be informed on current Society affairs. Also, the Committee on Society Functions has given some consideration to the possibility of a central nominating committee to suggest personnel for consideration as officers of Divisions and Sections of the Society.

Young Engineering Teachers' Paper Contest

The Secretary reported that most of the Sections had submitted entries in the Young Engineering Teachers' Paper Contest and that the Regional Judging Committees are making the semi-final selections.

ASEE Sponsorship of Education Conferences

The proposal of Vice President White for establishing an ASEE policy relative to sponsorship of Educational Conferences was presented to the Board. Briefly this policy would make it possible for the ASEE to endorse an engineering conference provided that:

1. it deals with engineering education,
2. it has responsible management,
3. there are no financial obligations to the Society,
4. one or more ASEE members are actively working on the planning committees.

The ASEE Executive Board would be given authority to approve ASEE sponsorship. This proposal will be referred to the General Council in June.

Fall Meetings of ECAC and ECRC

The Executive Board gave consideration to a possible theme for the Fall meeting of the ECAC-ECRC which will be held in conjunction with the ECPD Annual Meeting at the Statler Hotel, New York, October 15–17, 1953. One suggestion was that the ECAC and ECRC combine to develop a program on a general theme of the factors influencing creative thinking in engineering practice. No action was taken.

President Woolrich suggested that Dean Allen of CCNY be appointed as Chairman of the Fall meeting. The Executive Board approved.

Associate Institutional Membership

The Secretary stated that the Committee on Associate Institutional Membership, under the chairmanship of Jesse McKeon, is now contacting a large number of industries which have substantial engineering operations in order to expand the Associate membership in the Society. The Executive Board voted to accept the applications of the following companies for Associate Institutional Membership.

a) United Aircraft
b) ALCOA
c) IBM
d) Sandia Corporation
e) U. S. Steel
f) Institute of Paper Chemistry
g) Procter & Gamble

ECPD Appointment

A request from Dean Saville to appoint Professor Merryfield of Oregon State

College to succeed Professor Mockmore was approved by the Board.

Bank Resolution

The Executive Board voted in favor of a bank resolution permitting the Secretary to sign checks on a small petty cash account at the First National Bank in Evanston.

Respectfully submitted,

ARTHUR BRONWELL,
Secretary

College Notes

The **George Washington University** School of Engineering has announced that beginning next Fall it will offer a full curriculum leading to a Master of Engineering degree. This is the first time that such a program has been available at the University. Dean Martin Alexander Mason, of the School of Engineering, said that graduate degrees awarded under this plan would be in general engineering, not in any particular field. This, he said, is based on a policy to emphasize scientific principles and their application to engineering problems rather than to promote engineering as a particular art.

Present plans call for a division of the curriculum in three parts: one-half will cover up-to-date engineering problems; one-fourth will deal with mathematics; and one-fourth will be a review of modern principles of physics.

In the News

The **Foundry Educational Foundation** has announced that Mr. E. J. Walsh has become the Executive Director of the Foundation. The former Director, George K. Dreher, has joined the Waukesha Foundry Company as Manager of the Casting Division and a Director of the Company.

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Fourteen American geneticists have received grants from the **National Science Foundation** to attend the Ninth International Congress of Genetics in Bellagio, Italy, August 24–31, 1953. The awards were made from 120 applicants on the basis of their contribution to research in genetics. In making the selections, the National Science Foundation was guided by the recommendations of the Genetic Society of America.

Section Meetings

Section	*Location of Meeting*	*Dates*	*Chairman of Section*
Allegheny	West Virginia University	April 17–18, 1953	C. H. Cather, West Virginia University
Illinois-Indiana	Rose Polytechnic Institute	May, 16, 1953	H. A. Moench, Rose Polytechnic Institute
Kansas-Nebraska	Kansas State College	Oct. 9–10, 1953	M. H. Barnard, University of Nebraska
Michigan	Detroit Institute of Technology	May 9, 1953	C. C. Winn, Detroit Institute of Technology
Middle Atlantic	University of Delaware	May 2, 1953	C. Bonilla, Columbia University
Missouri	Washington University	April 11, 1953	G. F. Branigan, University of Arkansas
National Capital Area	Howard University	May 9, 1953	L. K. Downing, Howard University
New England	University of Vermont	Oct. 10, 1953	E. T. Donovan, University of New Hampshire
North Midwest	Marquette University	Oct. 9–10, 1953	A. B. Drought, Marquette University
Ohio	University of Cincinnati	May 2, 1953	H. K. Justice, University of Cincinnati
Pacific Northwest	Washington State College	April 24–25, 1953	J. P. Spielman, Washington State College
Pacific Southwest	San Jose State College	Dec. 29–30, 1953	C. M. Duke, University of California at Los Angeles
Rocky Mountain	University of Colorado	April 11, 1953	C. A. Hutchinson, University of Colorado
*Southeastern	North Carolina State College		D. V. Terrell, University of Kentucky
Southwestern	University of New Mexico	April 3 & 4, 1953	M. L. Ray, University of Houston
Upper New York	Rochester Institute of Technology	October, 1953	F. E. Almstead, State University of New York

Members of the Society are welcome at all Section Meetings

*** No Date Set.**

New Members

ALDERMAN, ALFRED A., Divisional Supervisor of Technical Training, Fisher Body Div., General Motors Corp., Detroit, Mich. K. A. Meade, E. L. Yates.

BAIRD, HOLLIS S., Instructor in Physics, Northeastern University, Boston, Mass. C. D. Johnson, W. T. Alexander.

BALDWIN, BRUCE B., Associate Professor of Mechanical Engineering, University of Cincinnati, Cincinnati, Ohio. H. K. Justice, J. W. Beatty.

BAUM, ROBERT M., Physicist-Engineer, Sylvania Electric Products, Inc., Newton, Mass. K. L. Horowitz, R. B. Leng.

BENNETT, JAMES L., Instructor in Engineering, Junior College of Kansas City, Kansas City, Mo. H. O. Croft, C. M. Wallis.

BIEHL, JOHN F., Mechanical Engineering, University of Cincinnati, Cincinnati, Ohio. P. K. Johnson, H. P. Rodes.

BIGNELL, JAMES F., Acting Professor of Engineering Drawing, University of Tampa, Tampa, Fla. W. J. Luzadder, J. N. Arnold.

BIRD, JAMES P., Instructor in Engineering, Junior College of Kansas City, Kansas City, Mo. H. O. Croft, C. M. Wallis.

BLEAKLEY, WILLIAM B., Assistant Professor of Petroleum Production Engineering, University of Tulsa, Tulsa, Okla. W. L. Nelson, R. L. Langenheim.

BOGHOSIAN, WILLIAM H., Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa. H. Sohon, J. R. Warren, Jr.

BOURNE, HENRY C., JR., Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. C. E. Tucker, K. L. Wildes.

BOYAJIAN, ARAM, Consulting Engineer, 55 Stratford Ave., Pittsfield, Mass. C. E. Tucker, G. S. Brown.

BROWN, SANBORN C., Associate Professor of Physics, Massachusetts Institute of Technology, Cambridge, Mass. W. R. Woolrich, R. B. Finch.

BUNTON, LAWRENCE O., Associate Professor of Textile Engineering, Texas Technological College, Lubbock, Tex. C. C. Perryman, O. A. St. Clair.

BUTHOD, ARTHUR P., Professor and Head of Petroleum Refining, University of Tulsa, Tulsa, Okla. R. L. Langenheim, J. C. Klotz.

CARTER, WILLIAM J., Associate Professor of Mechanical Engineering, University of Texas, Austin, Tex. M. C. Begeman, L. F. Kreisle.

CHANG, YI-CHUNG, Assistant Professor of Chemical Engineering, University of Tulsa, Tulsa, Okla. R. L. Langenheim, W. L. Nelson.

DAHLMAN, JOHN E., College Relations Representative, Glenn L. Martin Co., Baltimore, Md. F. W. Slantz, C. M. Merrick.

DAVIS, GEORGE E., Lecturer in Engineering Design, University of California, Berkeley, Calif. C. F. Garland, J. L. Meriam.

DAVIS, STEPHEN R., Instructor in Mechanical Engineering, University of Delaware, Newark, Dela. J. I. Clower, H. S. Bueche.

DOBYNS, SAMUEL W., Assistant Professor of Civil Engineering, Virginia Military Institute, Lexington, Va. R. A. Marr, Jr., J. H. C. Mann.

DURDEN, JOSEPH C., JR., Assistant Professor of Engineering Drawing and Mechanics, Georgia Institute of Technology, Atlanta, Ga. W. B. Ratterree, R. K. Jacobs.

DUWELIUS, THOMAS A., Assistant Professor of Civil Engineering, Rose Polytechnic Institute, Terre Haute, Ind. H. A. Moench, E. A. MacLean.

EATON, PAUL T., Associate Professor of Industrial Engineering, Georgia Institute of Technology, Atlanta, Ga. R. N. Lehrer, W. W. Cox, Jr.

EDGERTON, HAROLD E., Professor of Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. C. E. Tucker, K. L. Wildes.

FISHER, ROBERT A., Assistant Professor of Chemical Engineering, University of Denver, Denver, Colo. A. E. Paige, M. P. Capp.

FOSTER, DONALD V., Assistant Professor of Industrial Electricity, Pennsylvania State College, State College, Pa. E. A. Walker, K. L. Holderman.

FOSTER, EDWARD, Associate Professor of English, Georgia Institute of Technology, Atlanta, Ga. W. R. Woolrich, A. B. Bronwell.

FYFE, IAN M., Instructor in Mechanical Engineering, University of Delaware, Newark, Del. (Home: 201 S. Swarthmore Ave., Swarthmore, Pa.). J. I. Clower, R. V. Canning.

GANZER, VICTOR M., Associate Professor of Aeronautical Engineering, University of Washington, Seattle 5, Wash. J. B. Morrison, R. H. Smith.

GIET, GEORGE R., Professor of Electronics, U.S.N. Postgraduate School, Monterey, Calif. R. S. Glasgow, C. V. O. Terwilliger.

HANNAH, HORACE W., Associate Professor of English, Drexel Institute of Technology, Philadelphia, Pa. R. C. Disque, C. A. Kapp.

HARTWIG, WILLIAM H., Assistant Professor of Electrical Engineering, University of Texas, Austin, Tex. R. D. Slonneger, W. F. Helwig.

HEDRICK, J. E., Professor of Chemical Engineering, Cornell University, Ithaca, N. Y. J. C. Smith, F. H. Rhodes.

HENNEBERG, WALTER, Associate Professor of English, Drexel Institute of Technology, Philadelphia, Pa. H. R. Bintzer, R. S. Hanson.

HETTINGER, MATHIAS, Assistant Professor of Engineering, University of Buffalo, Buffalo, N. Y. P. E. Mohn, F. P. Fischer.

HIRTHE, WALTER M., Instructor in Mechanical Engineering, Marquette University, Milwaukee, Wis. J. E. Schoen, A. B. Drought.

HOAG, J. BARTON, Head, Science Department, U. S. Coast Guard Academy, New London, Conn. S. L. Smith, E. R. Rivard.

HOBGOOD, ALTON A., Assistant Professor of English, Georgia Institute of Technology, Atlanta, Ga. B. L. Brown, E. Foster.

HORTON, HORACE R., Assistant Professor of Electrical Engineering, Missouri School of Mines, Rolla, Mo. C. J. Grimm, J. B. Butler.

HUFSTEDLER, ROBERT S., Instructor in Chemistry, Colorado School of Mines, Golden, Colo. W. H. Dumke, R. A. Baxter.

JACKSON, KENNETH B., Professor and Head, Applied Physics, University of Toronto, Toronto, Ont., Canada. K. F. Tupper, A. Wardell.

JENKINS, LEO B., JR., Instructor in Electrical Engineering, University of Louisville, Louisville, Ky. M. G. Northrop, H. T. Smith.

JENSEN, MAX A., Associate Professor of Agricultural Engineering, State College of Washington, Pullman, Wash. J. Roberts, E. B. Moore.

JOHNSON, EDWARD F., Instructor in English, Newark College of Engineering, Newark, N. J. J. H. Pitman, J. T. Shawcross.

JONES, LLEWELLYN E., Assistant Professor of Mechanical Engineering, University of Toronto, Toronto, Ont., Canada. L. S. Lauchland D. G. Huber.

KENNEDY, JOHN J., Instructor in Civil Engineering, The Citadel, Charleston, S. C. J. C. Key, J. Anderson.

KIESELBACH, DAVID J., Educational Specialist, U. S. Air Force, Hayward, Calif. C. A. Rumble, W. W. Van Skiver.

KORTH, HENRY, Instructor in Mechanical Technology, L. I. Agricultural and Technical Institute, Farmingdale, N. Y. W. L. Rogers, D. W. Allee.

KRUGER, FRED W., Associate Professor of Mechanical Engineering, Valparaiso, Ind. H. C. Hesse, C. G. Peller.

LESSARD, ROGER, Associate Professor of Mathematics, Ecole Polytechnique, Montreal, Canada. H. Gaudefroy, C. R. Godin.

LINDBERG, ROY A., Assistant Professor of Mechanical Engineering, University of Wisconsin, Madison, Wis. C. A. Gilpin, P. H. Hyland.

MAINI, WILLIAM L., Instructor in Building Engineering and Construction, Massachusetts Institute of Technology, Cambridge, Mass. W. C. Voss, W. H. Gumpertz.

MARSHALL, THOMAS A., JR., Secretary, Engineers' Joint Council, 29 West 39th St., New York 18, N. Y. Thorndike Saville, A. B. Bronwell.

MARTINEZ, JOSE E., Assistant Professor of Civil Engineering, University of New Mexico, Albuquerque, N. M. W. C. Wagner, R. Foss.

MATTE, ANDREW L., Associate Professor of Electrical Engineering, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. C. C. Whipple, W. A. Liswer.

MENKES, SHERWOOD B., Lecturer in Mechanical Engineering, City College of New York, New York, N. Y. G. J. Bischof, A. L. Steinhauser.

MICHAELS, ALAN S., Assistant Professor of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. W. R. Woolrich, A. B. Bronwell.

MOON, GEORGE D., Instructor in Chemical Engineering, University of Cincinnati, Cincinnati, Ohio. H. K. Justice, C. Wandmacher.

MORGAN, NEWLIN D., JR., Associate Professor of Civil Engineering, University of Wyoming, Laramie, Wyo. H. T. Person, E. J. Lindahl.

NEWTON, GEORGE C., JR., Associate Professor of Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. C. E. Tucker, G. S. Brown.

O'BRIEN, ROBERT G., Personnel Representative, Johns Hopkins University, Applied Physics Laboratory, Baltimore, Md. C. E. Tucker, C. L. Townsend.

OORTHUYS, HENDRIK J., Assistant Professor of Electrical Engineering, Purdue University, Lafayette, Ind. L. E. Beck, C. R. Nichols.

OROWAN, EGON, Professor of Mechanical Engineering Massachusetts Institute of Technology, Cambridge, Mass. C. R. Soderberg, A. L. Townsend.

PADIS, LEO A., Assistant Professor of Mechanical Engineering, Virginia Polytechnic Institute, Blacksburg, Va. E. D. Harrison, J. B. Jones.

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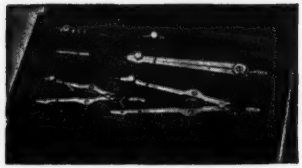

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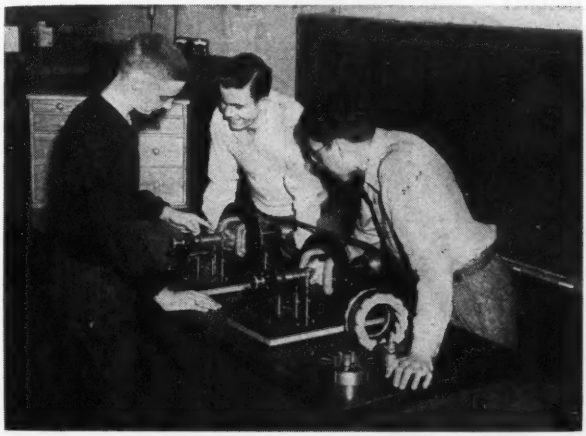

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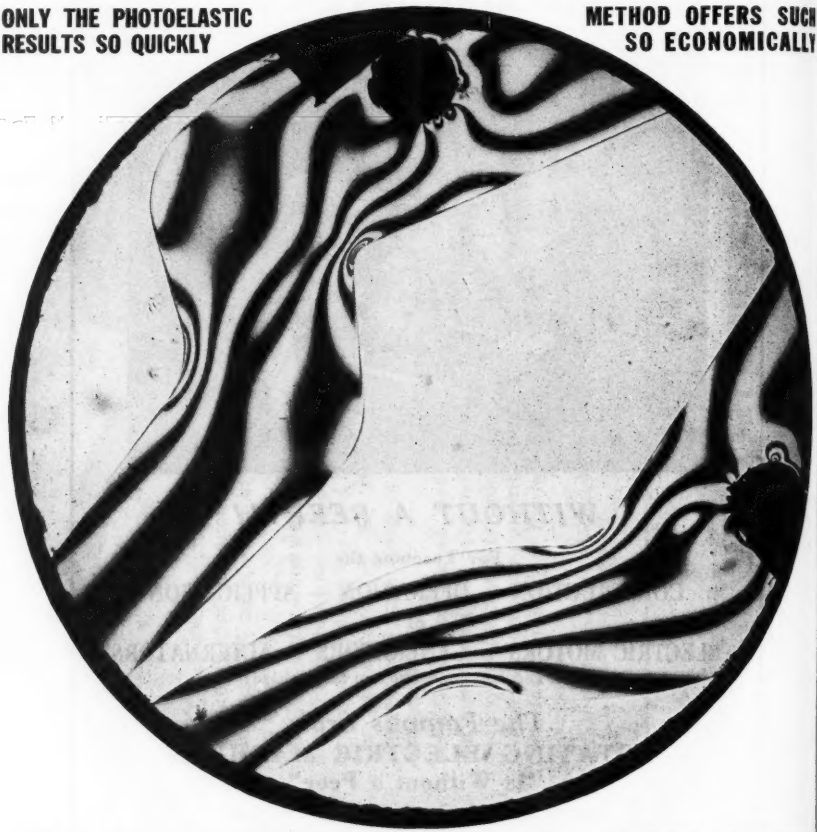

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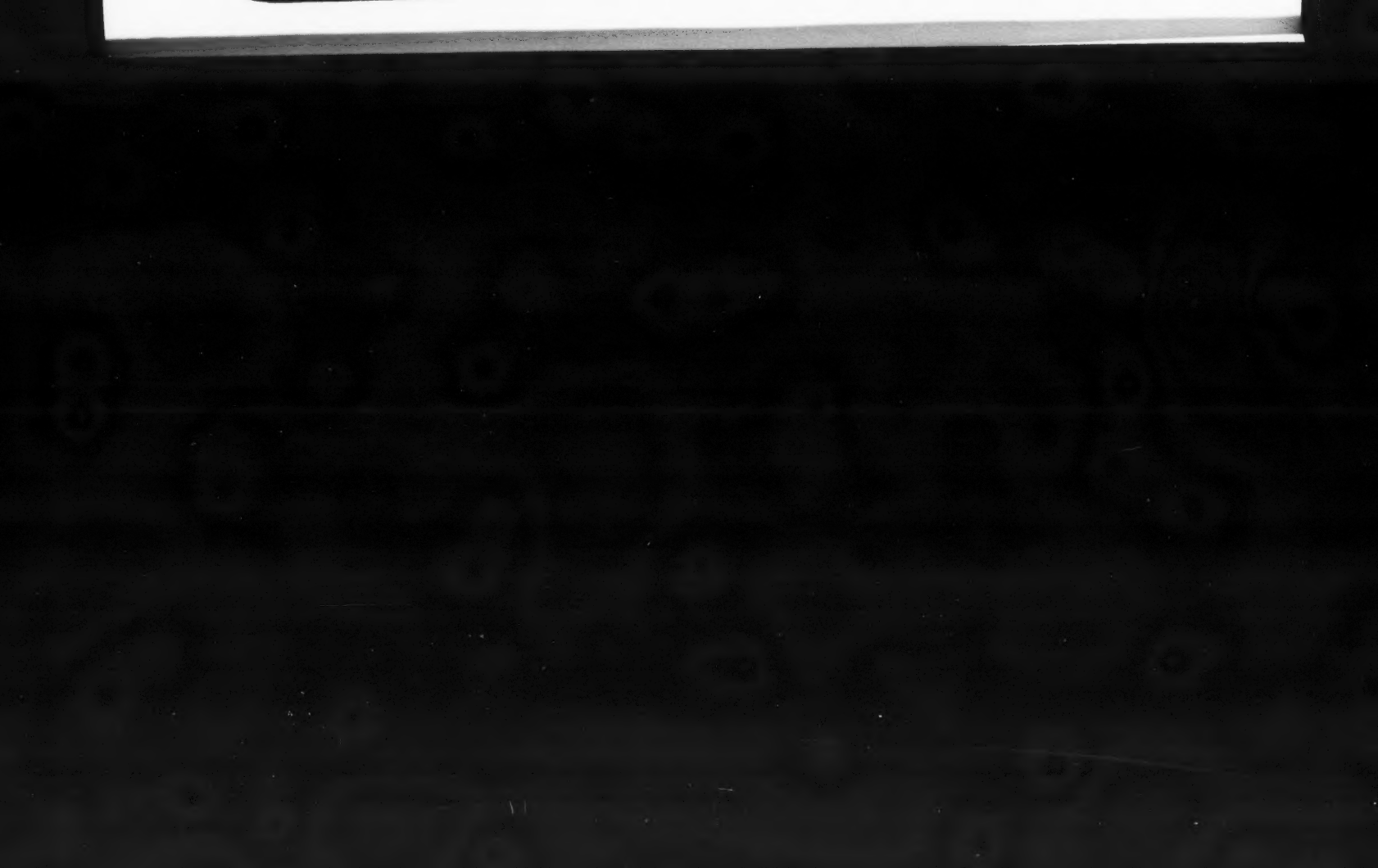

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